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THE DRIVE PROPERTIES OF INCONGRUOUS STIMULI

by

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ABSTRACT

The primary objective of this study was to investigate differential hypotheses derived from the theories of exploratory behavior developed by D. E. Berlyne and H. Fowler. The behavior of experimental concern was the visual exploration of incongruous stimuli.

According to Berlyne (1963), an incongruous stimulus generates perceptual conflict which he defines as an aversive drive directed towards the resolution of conflict by recognition of the component elements of the stimulus. After Berlyne (1957), incongruity was operationally defined in terms of a stimulus configuration with conflicting properties which simultaneously instigate incompatible responses.

On the basis of Berlyne's theory it was hypothesized that when subjects were exposed to an incongruous stimulus for a brief period of time, the presumed measures of drive would reflect a stronger tendency of the subject to be re-exposed to the same stimulus than when initial exposure to the stimulus had been for an extended period of time. Additionally, it was predicted that when subjects were exposed to an incongruous stimulus for a brief period of time, measures of drive would reflect a weaker tendency of the subject to be exposed to a different incongruous stimulus than when the first exposure had been an extended one.

For Fowler (1967), the relevant motivational variable associated with exploration is stimulus satiation. He defined stimulus satiation as a linear function of the duration of exposure to an unchanging stimulus which gives rise to a drive for stimulus change.

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theory provides no foundation for supposing that the subjects would prefer to be re-exposed to the same stimulus after either the brief or extended initial exposure intervals.

With respect to the major differential hypotheses, the critical finding of this study was that, following the brief initial exposure of an incongruous stimulus, subjects exhibited a stronger tendency to be re-exposed to the same stimulus as the one originally viewed than to be exposed to a different stimulus. This finding can be readily explained in terms of Berlyne's theory but cannot be accounted for in terms of Fowler's theory. Other significant results of the study also lend themselves to interpretation within the framework of Berlyne's conceptualizations but are unaccounted for in Fowler's theory.

An additional variable investigated in this study was the perceptual phenomenon of visual closure. It was hypothesized that, if closure ability is associated with efficiency of perceptual organization, possible perceptual conflict aroused by incongruous stimuli would be more speedily resolved in subjects with high closure ability than those with low ability.

The effect of closure was significant and in accordance with the interpretation that perceptual conflict was more speedily resolved in subjects with high closure ability.

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INTRODUCTION

Within the behavioral repertoire of organisms certain responses are evident which have been designated as "exploratory." This classification has been broadly interpreted by investigators in the field to encompass behaviors ranging from the relatively simple orienting reflex to the more complex activities involved in puzzle solving and creative expression. However, most of the experimental work in this area has been concerned with those responses directed toward facilitating inspection of some specific aspect of the environment by means of visual or auditory contact and/or tactile manipulation.

Investigatory activity has been scientifically observed in organisms ranging along the phylogenetic scale from the earthworm to man. Further, the incidence and persistence of this type of behavior has been shown to be commensurate with the neurological complexity of the organism. Because exploration provides the basis for a great deal of spontaneous learning, its role in the learning process has been emphasized by numerous behavioral scientists, most noteably the developmental theorist, Jean Piaget Consequently, it is generally conceded that any comprehensive motivational theory must take into account the importance of explorational tendencies and accommodate them within its explanatory framework. However, this was not always the case.

Despite the fact that over a century ago Bain (1868) wrote about "the craving of the senses for stimulation," it was not until the early 1950's that exploration became a popular subject for experimental research. Prior to the last two decades psychological investigators were primarily concerned with the motivation arising from biological surfeits and deficits associated

with the survival of the individual organism or of the species. The explorational activity noted in maze learning studies was viewed as the searching behavior of a deprived animal seeking the food or water necessary for the restoration of physiological balance. As a result of numerous observations of rats in this very limited type of situation, traditional drive-reduction theorists concluded that all exploration was motivated by a secondary drive originating in the primary need to satisfy the basic biological requirements.

Deprivation and Exploration

From an ethological point of view the relationship between exploration and the homeostatic appetites is a critical one. The survival value of exploratory behavior which is energized by deprivation is readily apparent. The hungry and/or thirsty animal that systematically and energetically investigates the novel aspects of its environment would generally have access to a greater selection of food and water sources than would a less active one.

This relationship has received considerable attention from researchers who have studied the locomotor activities of deprived versus satiated rats. However, due to the failure of early investigators to standardize the maze form utilized and to adequately discriminate between gross motor activity and specific investigatory responses, the results of these experiments were equivocal and even contradictory. For example, whereas Montgomery (1953) observed that food and water deprivation significantly reduced the number of sections traversed in an enclosed maze, Alderstein and Feherer (1955) found that rats explored 50% to 75% more units in a complex, asymetrical maze when hungry than when sated. Additional confusion was introduced when Thompson (1953) reported a significant difference between the exploratory behavior of hungry as opposed to satiated male rats in an elevated maze but failed to find this difference in females.

In an attempt to circumvent the confounding components of maze exploration, deLorge and Bolles (1961) used an open field. They found that, with increased food deprivation, there was a corresponding increase in "window peeking." On the other hand, open field behaviors such as locomotion and grooming either diminished or were unaffected.

Another study designed to measure the effects of deprivation upon response to novelty was carried out by Richards and Leslie (1962) who discovered

that when hungry and thirsty rats were placed in a T maze and permitted to choose between a novel tactile stimulus and one to which they had previously been exposed, the deprived rats chose the novel stimulus more frequently than the satiated ones.

The results of the two latter studies provided persuasive evidence that investigatory behavior and responses to novelty are facilitated by food and water deprivation. As previously noted, most of the original theorists had regarded exploratory activity as a secondary drive conditioned to the reward properties of novel stimuli present during the consummatory response directed toward the reduction of a homeostatic need. However, a small number of investigators were engaged in research that was to ultimately create widespread interest in exploratory behavior and was to lead to findings which required a reconsideration of the secondary drive interpretation.

Spontaneous Alternation

In 1925 Tolman had described a peculiar regularity in rat behavior. He reported that, with food available in both arms of a T maze, a rat would tend to spontaneously alternate routes over trials. If on the first trial the rat had entered the right hand arm of the maze, on the succeeding trial it would be inclined to enter the left, or opposite arm. This finding was later confirmed by Dennis (Dennis, 1935; Dennis & Sollenberger, 1934) who established that the frequency of this tendency to alternate was significantly greater than that of chance. A subsequent study by Heathers (1940) not only demonstrated that rats tend to avoid repeating a maze choice just made but also that this tendency dissipates progressively over time.

Historically, a number of alternative explanations have been offered for spontaneous alternation behavior:

Reactive Inhibition. The findings of Dennis and Heather prompted Solomon (1947) and Zeaman and House (1951) to attempt to assimilate spontaneous

within the Hullian theoretical model. In order to explain this phenomon they evoked Hull's concept of reactive inhibition. Hull (1943) speculated that reactive inhibition, which is similar in its effects to fatigue or pain, is generated whenever an organism makes a response and thus acts as a barrier to repetition. It dissipates with time and increases with the magnitude of the work required for each response. Zeaman and House hypothesized that when the rat made an initial right turn in the T maze, a certain amount of reactive inhibition would become attached to the right-turning response. As a result, the left-turning response would now require the lesser effort and the animal could be expected to turn into the left arm on the next trial.

Deductions based on Hull's theory include the reduction of alternation with time and, since reactive inhibition is a function of the amount of work, a relationship between alternation and the effortfulness of the response. The latter deduction was tested by Solomon (1948) who found that weights strapped to the backs of rats did not increase the frequency of alternation in a maze.

Stimulus Satiation. Glanzer (1953a) conceptualized alternation as being a stimulus process rather than a response process. In his view, it is stimulus satiation which reduces the tendency to make a response leading to immediate re-exposure to a stimulus. Glanzer presented his basic theory in the form of a postulate:

> Each moment an organism perceives a stimulus-object or stimulus objects, A, there develops a quantity of stimulus satiation of A.

Because stimulus satiation inhibits the organism's tendency to respond to a stimulus to which it has very recently been exposed, this concept has been labelled stimulus inhibition in line with Hull's reactive inhibition. Like reactive inhibition, stimulus satiation dissipates with time but Glanzer would not predict a relation between alternation and amount of work.

The results of two studies (Montgomery, 1952; Glanzer, 1953b) provided evidence that supported Glanzer's interpretation of spontaneous alternation. Both Montgomery and Glanzer demonstrated that it was the arms of the maze that were being alternated rather than the right-turning and left-turning responses. A cross(+) maze, constructed so that an arm could be blocked off in order to form a conventional T maze, was used in these experiments. The rat was started from opposite arms on alternate trials. This procedure had the effect of pitting stimulus and response processes against each other. It was found that when the rat entered from one side of the maze and turned into the right arm, it would tend on the second trial entering from the opposite side of the maze, to repeat the right turning response which would lead it into the previously unentered arm. Clearly, the animals were alternating stimuli rather than responses.

Additional evidence for Glanzer's theory was supplied by Kivy, Earl and Walker (1956). In this experiment rats were permitted to explore the choice point of a T maze but were prevented from entering either arm by a transparent glass partition. During the exposure trial both arms of the maze were black. On the subsequent choice trial in which one arm of the maze had been changed to white, the animal tended to enter the arm which had been changed.

Stimulus Change. In 1956 Dember conducted an experiment which presented some difficulty for the stimulus satiation formulation. Rats were allowed to explore the choice point in a T maze in which the arms were blocked off by glass partitions as in Kivy, Earl and Walkers' study. However, during the exposure period in this experiment one arm of the maze was black and the other was white. On succeeding trials, the rat, faced with a choice between two stimuli for which it was equally satiated, tended to enter the arm which had been changed either from black to white or from white to black. Dember's

finding cast doubt upon the adequacy of the stimulus satiation concept because this result could not be predicted on the basis of Glanzer's theory. In attempting to integrate the studies involving exploratory behavior or novelty, Dember (1961) proposed that these are all cases of the organism seeking stimulus change. Alternation represents, in simple form, the basic characteristic of motivated behavior which is the "optimization of amount of stimulus variability or complexity."

"Curiosity" Drive. Yet another view of the motivational determinant of alternation was proposed by Montgomery (1952) who speculated that alternation was a special case of exploratory behavior instigated by a curiosity drive. Accordingly, exploration is elicited by novel stimuli, the strength of the drive being a decreasing function of time of exposure. Alternation, therefore, can be explained in terms of relative novelty. The exploration of one arm of the maze reduces its novelty so that on the succeeding trial the animal will prefer the more novel alternative.

In 1958 a study was undertaken by Miles which was designed to discover if learning for exploratory and manipulable incentives could be demonstrated in the absence of prior association of these activities with drive reduction. Kittens were used as subjects in this experiment and their past history was controlled so that neither exploratory nor manipulatory behavior was associated with a reduction in drive. It was observed that, while eating, the kittens did not handle either the food or the food dish which was promptly removed after each feeding. The kittens were then trained in a Y maze on a position habit with manipulable objects as incentives. After removal of the incentives from the maze, the subjects exhibited a typical extinction function. Moreover, with the food dish present as an incentive in one arm of the maze, the kittens learned to reverse their original position habit by entering the other arm for a reward condition which allowed them to

explore the room for a short time. Thus the kittens learned a reversal habit in order to explore the room when this reversal was opposed by a strong acquired reward, the food dish.

The results of Miles' experiment led to consideration of exploratory behavior as being autonomously motivated and lent credence to Montgomery's notion of a curiosity drive which is elicited by novelty and is independent of secondarily derived incentives.

Novelty reduction is essentially similar to stimulus satiation but the concept of a curiosity drive is one that has been widely criticized by drive reduction theorists. Their basic objection to this formulation is that drive is alternately raised and lowered by exposure to the same novel stimulus, an eventuality which cannot be readily accounted for by traditional drive theory.

Traditional drive theorists have argued that, according to the curiosity drive formulation, novel stimuli are both drive producing and reinforcing. Thus, it may be concluded that novel stimuli are unique among reinforcers in that their reinforcing effects are obtained through an increase in drive. Because drive theory is committed to the position that only a reduction in drive can be reinforcing, the assumptions of a curiosity drive, as proposed by Montgomery, are untenable for these theories.

"Boredom" Drive. It was Myers and Miller (1954) who introduced the notion of a boredom drive. They suggested that homogeneous or monotonous stimulation produces a drive which may be reduced by sensory variety. In effect, these authors ascribe drive inducing properties to stimulus satiation and have elevated satiation to the status of a motivational construct within the framework of traditional drive-reduction theory.

In support of their interpretation, Myers and Miller reported an experiment in which they demonstrated that physically satiated rats will learn a

bar pressing response in order to open a door leading from either a black to a white compartment or from a white into a black one. These investigators speculated that exposure to the original compartment produced a boredom drive which motivated the bar pressing behavior resulting in the reinforcement provided by the novel compartment.

However, although both the experimental operations and the results of the Myers and Miller study conformed to the drive-reduction paradigm, some theorists have rejected this motivational model and have cited the findings of other studies in the area to justify their position. For example, Harlow (1953) found that monkeys would work for long periods of time solving puzzles requiring them to release a pin in order to lift a hasp from a staple and to remove a series of hooks from a corresponding set of eyes. It appeared that the animals would perform these tasks under the influence of the high level of stimulation produced by the performance of the necessary manipulations and with no reward other than the reinforcement intrinsic to the operations involved.

Optimal Stimulation. Rejecting the principle that drive reduction is an essential feature of learning, Leuba (1955) proposed that the reduction of drive is but one subordinate component of a more general principle which he termed "optimal stimulation." Accordingly, the optimal level is achieved by means of behavioral responses which "when overall stimulation is low, are accompanied by increasing stimulation; and when overall stimulation is high, those which are accompanied by decreasing stimulation."

Optimal Arousal. A physiologically oriented theory, essentially an extension of Leuba's position, was introduced by Hebb (1955). He suggested that the total stimulation to which an organism is exposed affects behavior through the medium of sensory feedback from the cortex which activates the arousal system located in the brain stem. Because Hebb conceptualized arousal as

being solely an energizer to which he ascribed no cue function, he equated the organism's level of arousal with its state of general drive and thus, for him, these two constructs were interchangeable.

Following Leuba, Hebb proposed an optimal level of arousal representing the degree of arousal (or drive) that is most conducive to learning. Consequently, he concludes that, ". . . at low levels an increase of drive intensity may be rewarding, where at high levels it is a decrease that rewards."

Optimal Activation (Arousal). In 1961 Fiske and Maddi published a general theory of motivation in which they made extensive use of the concepts developed by Dember, Leuba and Hebb. According to Fiske and Maddi, stimulus variation has an arousing effect upon the organism. This arousal is activated by the impact of the stimulus and the impact is a function, not only of the variation provided by the stimulus, but also of its intensity and its perceived significance. Impact producing stimulation may come from exteroceptive, interoceptive or cerebral sources.

Fiske and Maddi postulated three aspects of stimulus variation:

1) A stimulus can differ from the preceding one and the larger the difference the greater will be the impact from this source.
2) A stimulus can be novel. However, novelty should be regarded as relative because very few stimuli are entirely new or strange. Novelty results from the extent that a stimulus differs from the total range of previously experienced stimuli and is also dependent upon the length of time which has elapsed since the previous experience.
3) A stimulus can depart from some pattern or regularity. This departure from regularity produces unexpedtedness being related to the strength of the expectancy built up by prior experience.

These three aspects of stimulus change involve differences in either meaning or intensity. Therefore, total stimulus impact includes all three sources of impact and their interaction.

Fundamental to Fiske and Maddi's theory is the concept of an optimal level of activation (arousal). Thus, when these authors assert that both increases and decreases in arousal may be reinforcing (depending upon the individual's level of stimulation and arousal) they are joining Leuba and Hebb in their deviation from the traditional drive-reduction-reinforcement model.

The foregoing account has been a brief outline of the evolution of some of the experimental work and theoretical speculation which was to influence the development of the two major theories in the area of exploration with which this paper is primarily concerned.

Berlyne's Two Factor Theory of Exploration

Initially, Berlyne (1950; 1955) dealt with exploratory behavior as part of a general plan to extend Hullian principles into the area of perception. The two major postulates of his system were:

1) When a novel stimulus affects an organism's receptors there will occur a drive-stimulus producing response called curiosity.
2) As a curiosity arousing stimulus continues to affect an organism's receptors, curiosity will diminish.

The process hypothesized by Berlyne takes place under the Hullian model of extinction with both reactive inhibition and conditioned inhibition being generated. Thus a novel stimulus evokes a response which leads to a drive-stimulus and with continued exposure extinction will occur.

Berlyne (1960) regarded the curiosity drive as having reference to a wide range of behavioral events for which no specific biological function could be identified. In his view, this drive state is induced by experienced

uncertainty resulting from insufficient information in a given environmental situation.

In 1963 Berlyne presented a systematized theory of behavior which incorporated the concept of optimal arousal within its motivational framework. Like Fiske and Maddi, he proposed that behavior is directed toward maintaining an optimal level of arousal, this level being determined by the impact of the stimulation to which the organism is exposed. For Berlyne, stimulus impact is a function of both the novelty and intensity of the impinging stimulation.

However, there is a critical difference between the theoretical positions of Fiske and Maddi and Berlyne with respect to the concept of arousal or drive. Whereas Fiske and Maddi concluded that both increements and decrements in drive level could be reinforcing, Berlyne handled arousal within the traditional Hullian drive reduction paradigm. With his proposal that arousal is a U-shaped function of stimulus impact, Berlyne was able to show that both high and low values of stimulus impact could produce high arousal or drive (see Figure 1).

On the basis of this hypothesized relationship between drive and stimulus impact Berlyne (1963; 1965) has developed a two-factor theory of exploratory behavior based on a distinction between specific and diversive exploration.

Diversive exploration is likely to occur when an animal has spent some time in dull or monotonous surroundings and thus diversive exploration has the function of ". . . introducing stimulation from any source which is 'interesting' or 'entertaining'." In this connection, Berlyne speaks of an aversive condition of "boredom" which may motivate the individual to seek out diversive stimuli and which may be reinforced by this type of stimulation.

Specific exploration, on the other hand, is behavior which is aroused by an aversive condition which Berlyne refers to as "perceptual curiosity." This condition is induced when perception of a sector of the stimulus field leaves the organism in a state of uncertainty with regard to its characteristics. Specific exploratory responses have the aim of providing additional information through the prolongation or intensification of stimulation from particular sources which are relevant to the stimulus field.

According to Berlyne, the primary determinants of specific exploration are a class of stimulus properties described by the terms, 'novelty', 'change', 'surprisingness', 'incongruity', 'complexity', 'ambiguity', and 'indistinctness'. He refers to these as collative properties because they all depend upon collation or comparison of information from different stimulus elements and all involve subjective uncertainty which can be described in information-theoretic terms. Berlyne points out that this kind of uncertainty is a function of subjective "probabilities" and should not be confused with the objective probabilities of information theory.

For Berlyne, conflict is the essential feature underlying the motivational effects of the collative variables. Perception of a collative stimulus simultaneously instigates at least two incompatible response tendencies. It is the conflict produced by the activation of these mutually inhibitive responses which generates the drive for specific exploration. Subsequent exploration serves the function of resolving conflict-induced uncertainty through the receipt of information leading to the emergence of a prevailing response.

In 1957, Berlyne empirically demonstrated that the conflicting elements in surprising and incongruous stimuli could evoke 'perceptual curiosity' as measured by the number of instrumental responses performed in order to obtain a series of brief exposures to stimuli with these characteristics.

In this experiment human subjects were seated in a darkened room facing a tachistoscope. Depression of a finger key resulted in a brief (.14 sec.) exposure to a stimulus card and the number of key presses to view a particular card was assumed to reflect the intensity of the drive aroused by the stimulus figure pictured on the card. Berlyne found that when a single stimulus card combined two properties which the subjects had learned to regard as incompatible (incongruity-conflict), the mean number of responses for exposure to cards of this type was significantly higher than for cards depicting congruous figures. Also, there were significantly more responses made for cards which failed to confirm expectations produced by exposure to preceding cards (surprise-conflict).

In a later series of studies, (Berlyne, Craw, Salatapek & Lewis, 1963; Berlyne & Lewis, 1963; Berlyne & McDonnell, 1965) Berlyne and his associates showed that arousal, as measured by EEG frequency and GSR magnitude, was positively related to collative variables such as novelty, surprisingness and incongruity. Because Berlyne (1960; 1963) has equated arousal with the energizing aspect of drive, these studies provided additional evidence that the collative variables are drive inducing.

With respect to perceptual curiosity, the drive elicited by collative stimulus properties is considered to be specific in character because it is directed solely toward the acquisition of that particular information which has the capacity to relieve a conflict-produced uncertainty. When conflict is unduly high other forms of behavior such as flight or withdrawal may be exhibited, but when conflict is moderate in intensity the preferred mode of conflict diminution will be specific exploration. This tendency to explore is especially compelling in the case of human beings in whom ". . . symbolic representations of stimulus patterns are apt to linger after they have left

the stimulus field and to prolong any disturbance to which the stimulus pattern gave rise."

The goal of specific exploration is the reduction of perceptual conflict by means of a modification of cognitive structure which leads to the recognition, classification or categorization of a stimulus complex. This structural reorganization ensues when exposure to new information results in a resolution of the incompatibility of the conflicting responses, to the introduction of a novel response which is stronger than the competing ones, or to a strengthening of one of the conflicting responses in relation to the others. Thus specific exploration may be viewed as sharing common characteristics with decision making and other problem solving behaviors.

It is evident that when Berlyne ascribed aversive qualities to monotonous surroundings he is aligning himself with the 'stimulus satiation' theorists - Glanzer, Myers and Miller - but when he discussed specific exploration he places himself within the 'curiosity' camp with Montgomery, Butler and Harlow. It is this latter position involving the concept of perceptual curiosity that has been criticized by Fowler (1965) who objected to Berlyne's formulation on two counts: "One could argue, then, as Berlyne has, that novel, unexpected, and/or perceptually ambiguous stimuli first raise and then reduce drive, the two processes of drive induction and then reduction (reinforcement) taking place in immediate succession. Unfortunately, there are two difficulties inherent in this position; first, for the conceptualization to be meaningful and thus assessable, reference must be made to the two processes in contexts that are clearly separable and definable as such in terms of specific operations, but this would seem virtually impossible; secondly, by assigning drive-inducing properties to novel, unexpected or ambiguous stimuli, there appears to be no clearly

discernible basis for predicting exploration because it logically follows that the animal may reduce its curiosity drive by simply turning away from these stimuli rather than exploring them."

Fowler's Single Factor Theory of Exploration

Fowler's theory represented an attempt to explain exploratory behavior exclusively in terms of the drive reduction model. Fowler (1965; 1967) rejected Berlyne's distinction between specific and diversive exploration. For him, all exploration is diversive in character and is motivated by a 'boredom' drive arising from stimulus change deprivation. By taking this position, Fowler avoided the necessity for ascribing both drive-reducing and drive-inducing properties to the same novel stimulus and made it possible to account for exploration within the framework of traditional drive reduction theory.

Expanding upon Myer and Miller's concept of a 'boredom' drive, Fowler theorized that boredom motivation may be defined in terms of the length of time that the organism is exposed to a relatively unchanging stimulus condition.

Curiosity, on the other hand, is the organism's learned 'anticipation' of the novel or unfamiliar stimuli that it experiences upon performing some instrumental response. Thus 'curiosity' is an incentive-motivational construct which may be defined in terms of the magnitude of the stimulus change for which the animal previously responded and is classically conditioned in the same manner as the fractional anticipatory goal response of Hull (1953) and Spence (1956).

For Fowler, there is no intrinsic difference between the mechanisms underlying exploration and those involved in appetitive and escape behaviors. The presence of food elicits the response of eating in the hungry animal;

intense stimulation; e.g., shock, induces withdrawal or escape reactions and similarly, a change in stimulation evokes the consumatory response of exploration. Also, just as increasing amounts of food and greater intensities of shock elicit, respectively, more salivating, chewing and more vigorous escape activity, so do greater changes in stimulation induce more responses such as 'orienting to, attending to, and perceptually ingesting stimulus change'. However, Fowler imposed a limit upon the magnitude of the change which would be effective in producing investigation. He pointed out that change in the direction of too great intensity or too much novelty may result in fear reactions and, consequently, would at least temporarily, not be conducive to exploration.

When Fowler included 'perceptual ingestion' as comprising one aspect of the consumatory response to stimulus change he did not elucidate upon the specific meaning of this term. In his 1965 paper Fowler related exploration to information theory by stating that, "The picture is one of the organism needing, seeking, and processing information, not in the sense of receiving signals or stimulus input, but in the full theoretical sense of the word." This statement indicated that he had made entropy, or the reduction of uncertainty, the goal of exploration and this view moved his theoretical position closer to that of Berlyne. However, in a later and more extensive article (1967), Fowler made no reference to information theory and did not attempt to accommodate this conceptualization within his subsequent formulation.

In this later article, Fowler described four experiments in which he undertook to identify and investigate the relationships among some of the motivational variables associated with exploration. In addition, he hoped to demonstrate an integrating principle which would link studies such as

those of Butler (1957) and Fox (1962), which showed that the rate of responding for visual incentives was positively correlated with the duration of visual deprivation, with the studies of other investigators (e.g., Henderson, 1953; Stewart, 1960) who had found that the frequency of responding for changes in light illumination would increase correspondingly with heightened intensities of illumination.

Fowler was particularly interested in determining the effects of short term stimulus change deprivation upon exploratory activity. His speculation that short term satiation is a relevant variable was based on an alternation study by Glanzer (1953) who reported that when rats were exposed to one arm of a T maze and then were permitted to choose between the two arms on the next trial, the tendency to alternate arms is greater if the time of exposure to the initial arm is for 15 or 30 minutes rather than for only one minute.

Fowler's first experiment was an attempt to discover whether the concept of an exploratory drive could be operationally defined in terms of the duration of exposure to a stimulus complex prior to the opportunity for exploration of a relatively novel stimulus situation. The equipment utilized in this study consisted of two compartments joined by a runway. Rats were confined in the first compartment, which was painted black, for either 1, 3 or 7 minute periods. They were then released and allowed to explore the second compartment which had white side panels, for periods of either 0, 1 or 3 minutes. As predicted, Fowler demonstrated that longer exposure periods in the start compartment produced faster runway performance whereas more extensive exposure to the relatively novel goal surround resulted in progressively slower running speeds. However, in assessing the results of this experiment he concluded that confinement per se could have accounted for the obtained differentials in running speed.

In his second experiment, therefore, Fowler sought to avoid the possible confounding effects of confinement by holding exposure time in the goal compartment constant for all the animals over all trials. In this study, after an initial exposure of either 3 or 7 minutes in a black start compartment rats were permitted to explore, for one minute, a goal compartment which differed in brightness from the first compartment, the difference being varied across groups. Results indicated that running speed was positively related to start compartment exposure time, to increasing goal brightness and, consequently, to the magnitude of the difference in brightness between the start and goal compartments.

Fowler interpreted the findings of these first two experiments as providing a basis for defining stimulus exposure as a drive inducing operation and for defining brightness change as an incentive operation. As a consequence, his third study was primarily concerned with evaluation of the presumed motivational or "performance" aspect of these variables. In order to test the effects that alteration of drive reinforcement conditions would have upon performance, he independently switched, late in the runway training of different groups of rats, either the start-exposure or goal-brightness condition to which they had been subjected earlier in their training. It was found that changes in training conditions produced rapid shifts in runway performance which were appropriate to the newly imposed training conditions.

Fowler's final experiment was designed to examine the effects on runway performance of the differences between the brightness of the start compartment and the rats' rearing and maintenance cages. He found that by the end of training, running speed was independent of prior rearing brightness but that runway performances corresponded to the degree of brightness similarity between the maintenance cage and the start compartment from which the rat was

run. This finding led Fowler to the conclusion that ". . . performance instrumental to a change in stimulation is dependent not only on the similarity and duration but also the recency, or temporal proximity, of those stimulus conditions to which S is exposed prior to its exploration of the novel or changed stimulus condition."

Specific predictions based on Fowler's theory are derived from his formula adapted from Spence (1956):

$$R = \overset{N}{H} \times \left(\overset{T_e,\, P_e,\, C_e,}{D} \times \overset{M_c,\, T_e,}{K}\right) - \overset{N_c}{I}$$

R - strength of the tendency to respond

H - function of the number of training trials (N)

I - relates positively to the number of non-reinforced training trials and possibly to the delay in reinforcement following response evocation

D - Drive is operationally defined as an increasing monotonic function of the time or length of S's exposure (T_e) to the stimulus condition that antedates or is concommitant with the observed response. D includes an additional parameter of exposure (P_e) to the observed response. An additional determinant of D is the constancy of S's exposure condition (C_e). The satiation-drive effect relates positively to the constancy or homogeneity of S's condition of exposure

K - Incentive motivation is operationally defined in terms of the magnitude of the change in stimulation (M_c) that is made contingent upon the observed response. Value of K is also determined by the length of S's exposure (T_e) and the number of trials on which a change is provided (N_c).

Fowler's definition of 'curiosity' as the animal's conditioned anticipatory reaction to stimulus change reward (r_c) provides the mechanism by which K exerts its influence upon the instrumental response which leads to stimulus change.

This construct also provides the basis for proposing a general 'curiosity' factor. Fowler stated, "With the curiosity construct given reference in the present formulation to the animal's acquisition of a condition of object-specific anticipatory reaction, it should not be overlooked that the animal's previous history may be replete with conditioned anticipatory reactions of orienting to and perceptually attending to each and every novel or changed condition experienced. Thus, it may well be that, as a result of the animal's continuous encounter with stimulus variation (literally a change at every turn) an anticipatory investigatory reaction is conditioned generally in the manner of a learning set." Consequently, Fowler is able to account for exploratory behavior which may occur in the absence of conditions which produce boredom.

The Present Study

The primary objective of this study is to test differential hypotheses derived from the theories of Berlyne and Fowler. For purposes of prediction the critical dissimilarity between the two formulations lies in the drive properties of the perceptual curiosity and stimulus satiation conceptualizations.

According to Berlyne, when perceptual curiosity is aroused by a stimulus pattern, only the recipient of information relevant to that specific stimulus configuration is reinforcing. Furthermore, although perceptual curiosity eventually dissipates with time, the perceptual conflict may endure in symbolic form for some unspecified period.

Berlyne's assertions lead to the following expectations:

Hypothesis I

When subjects are exposed to an incongruous stimulus configuration perceptual conflict will be generated. When this exposure is for a brief period and the subjects are then given an opportunity to view the same stimulus it is predicted that indicators presumed to measure drive will reflect a decided preference to view the same stimulus configuration in order to reduce perceptual conflict. On the other hand, when subjects are exposed for an extended period of time to an incongruous stimulus configuration, it is predicted that perceptual curiosity will be resolved and that they will then prefer to view a different incongruous stimulus.

For Fowler, the relevant variables underlying the tendency to explore are the length of time that an organism has been deprived of stimulus change and the anticipated magnitude of change in stimulation that is made contingent upon the instrumental response. Fowler's formulation leads to the following expectations:

Hypothesis II

It is predicted that when subjects are briefly exposed to an incongruous stimulus complex, measures of drive will reflect a weaker preference to view a different incongruous stimulus than when exposure to the initial stimulus is an extended one.

However, because some increment of satiation is built up over time, Fowler's theory provides no foundation for predicting that the subject would prefer to view the same stimulus complex after either the brief or the extended pre-exposure periods.

Therefore, the major conflicting predictions originating in the theories of Berlyne and Fowler are concerned with subject preference for either same

or for different stimulus viewing following brief initial exposure to an incongruous stimulus.

Closure

It was the Gestalt psychologists who first drew attention to a phenomenon of visual perception which they termed 'closure'. They were referring to the tendency of an individual to recall an incomplete configuration, such as a circle with a missing section of contour, as having been nearly intact than was actually the case. This effect was stated as a principle of perceptual organization by Koffka (1935) who wrote, "Closed areas are more stable and therefore more readily produced than unclosed ones."

It is important to be aware that, originally, closure was operationally defined in terms of the tendency, in retrospect, to report a readily recognizable geometric figure as being closer to completion than, in fact, it was. This type of visual closure was essentially a form of optical illusion in which the recollection of the figure did not match the actual representation but was influenced by the subject's anticipation based on prior knowledge of the appearance of the completed figure.

The standard tests which have subsequently been developed to investigate the phenomenon of closure have required the identification of an incomplete depiction of a complex stimulus configuration. Although the possibility of an illusory component cannot be entirely dismissed, this ability, for the most part, requires the subjects to perceptually organize the given elements of the stimulus in such a way that an inference may be made as to the nature of the missing cues. Consequently, closure has been operationally redefined in terms of the ability to correctly label an incomplete configuration.

The first widely used test designed to measure closure tendencies was

introduced by Street (1931). The Gestalt Completion Test requires identification of the subject matter of a series of pictures in which some relevant, distinguishing details have been omitted. This test, or variations thereof, has since been employed as a measure of visual closure ability in most of the studies in the area up to the present time.

Thurstone (1944) revised Street's Gestalt Completion Test and included the revision in the test battery which he developed for use in his factorial analysis of perception. Two factors emerged from this analysis which Thurstone identified as flexibility of closure and speed of closure and which he subsequently added to his inventory or primary mental abilities. These factors were also isolated by Bechtoldt (1947), Botzum (1951) and Pemberton (1952a) and were described by Botzum as follows:

Flexibility of closure - Facility in organizing simultaneous visual configurations under the distraction of continuing activity.

Speed of closure - Facility in restructuring perceptual material possessing a weak intrinsic structure.

Both Botzum and Pemberton found a positive relationship between flexibility of closure and measures of analytic and deductive reasoning but speed of closure appeared to be a purely perceptual factor. Support for this conclusion was provided by Mooney (1957) who discovered that closure ability in children was independent of age. On the other hand, a study by Pemberton (1952b) yielded a positive correlation between speed of closure and certain personality traits. She reported that people with high closure ability tended to be tidy and systematic and that they were inclined to avoid ambiguity.

In 1951, Mooney and Ferguson constructed a paper and pencil test of visual closure which represented a development of the test originally

created by Street. The items were similar to the ones used by Street but the essential structures of many of the incomplete figures were more difficult to apprehend than those of previous tests. Consequently, Mooney and Ferguson found striking differences in perceptual closure ability. These authors concluded that, "These closures appear to be instances of simple insight at the perceptual level. They cannot be 'reasoned out', nor is there any device whereby they can be willfully effected. An 'insight' comes or it does not; it may come at once, in one instance, or belatedly in another."

With reference to Berlyne's theory, as previously speculated, when subjects are permitted to view an incongruous stimulus for a brief period of time, perceptual conflict will be generated, not only by perception of its incompatible components, but also by the brevity of the exposure. That is, it would be anticipated that, during a very brief exposure period when the subject is limited to a mere glimpse of the stimulus configuration, there would not be sufficient time for him to fully perceive all of the relevant cues associated with identification of the stimulus. The subject's perceived information regarding the incongruous figure could, in a sense, be conceptualized as being 'incomplete'. Thus, his situation would be somewhat analogous to that of a subject required to recognize the subject matter of a stimulus configuration in which some of the identifying cues had been omitted.

It is the secondary purpose of this study to examine the possible effects of high and low closure ability upon performance in the various experimental conditions. If closure is related to efficiency of perceptual organization it may be speculated that the perceptual conflict aroused by incongruous visual stimuli would be more speedily resolved in subjects with high closure ability.

METHOD

The present research was comprised of two experiments. The essential difference between them hinged upon the subjects' freedom to choose a particular stimulus for viewing. In Experiment I, following initial exposure to an incongruous stimulus, subjects were either re-exposed to the same stimulus ("Same-Condition") or were shown a different incongruous stimulus ("Different-Condition") depending upon the experimental condition to which they were assigned. Thus, these subjects had no part in the selection of the second stimulus. In contrast, in Experiment II, after the initial exposure to an incongruous stimulus, each subject had the choice of viewing either the same stimulus or a different incongruous stimulus.

Subjects. Fifty subjects participated in this study, 32 male and 18 female students at the University of Alberta who volunteered as subjects in order to meet requirements for an introductory course in psychology. Students indicated their willingness to take part in the study by writing their names, telephone numbers and a preferred date and time for testing in a booklet provided for this purpose. Of the total sample, 40 served as subjects in Experiment I and 10 as subjects in Experiment II. Half of the subjects in Experiment I were randomly assigned to the "Same-Condition" and the other half were assigned to the "Different-Condition." Randomness of assignment to conditions were achieved by writing the numbers from 1 - 40 on separate pieces of paper and placing them in a container in which they were thoroughly mixed. Twenty numbers were then drawn and matched with the order of subject appointments. For example, the number 8 would represent the eighth subject scheduled to come for testing. The subjects whose positions in the appointment sequence corresponded to the 20 numbers drawn from the container were tested in the "Same-Condition" and the remaining 20

subjects in the "Different-Condition." For reasons which will be discussed later in this chapter, no such random assignment of subjects was necessary in Experiment II. The subjects in both experiments were tested individually in sessions which varied in length from 20 minutes to one half-hour and which took place in the morning, afternoon or evening at hours convenient to the subjects.

Testing Room. Testing was conducted in a room, 9 X 10 feet, which contained two rectangular tables and three chairs (Figure 2). In order to control for variations in external conditions of light or darkness, the two windows in the room were covered by black, felt-like cloth. Visual difficulties presented in the adjustment from relative darkness to a brightly lit screen were overcome by dim illumination from an overhead flourescent lighting fixture with a single operative tube.

Stimulus Slides. Sixty-four 2 X 2 in. coloured projector slides consisting of 32 different slides, each duplicated once, were utilized in this study. The 32 different slides were randomly assigned a number from 1 - 32 corresponding to the order in which they were drawn from a container in which they had been placed and shaken.

The stimulus slides were developed from composite pictures pasted onto cardboard squares. The pictures were made up from cut-out parts of illustrations of people, animals and objects. These various parts were recombined to produce incongruity which was manipulated to conform to Berlyne's (1957) definition of "incongruity conflict," described as being aroused by a stimulus pattern the elements of which the subject has learned to regard as incompatible.

The conflicting characteristics of the stimulus slides fell into two general categories: (1) juxtaposition, e.g., a giraffe's head superimposed

upon a zebra's body; and, (2) distortion, e.g., a small chicken perched upon a large egg. Additionally, the depicted stimuli varied in complexity and degree to which their component elements were incompatible (see Appendix A).

Apparatus. Two kodak carousel slide projectors, fitted with 5 in. lenses, were placed three feet apart on a table at a distance of 6 feet from a 40 X 40 in. projector screen. They were positioned at a convergent angle so that both machines were focused upon the same central portion of the screen (see Figure 2).

EXPERIMENT I

Projector 1 - This projector was operated by the experimenter who pushed a button to present the initial slide in each series of two slide presentations. The length of presentation of this slide was controlled automatically by a manually set timer.

Projector 2 - This projector was operated by the subject by means of a hand control. When instructed to do so by the examiner, the subject pressed a button on the hand control in order to cause the second slide in the series to be projected onto the screen; his second button press caused the disappearance of that slide and the presentation of a darkened screen. The latter effect was created by projection of slides made of cardboard. Thus each alternate button press caused the screen to remain dark during the interval between the stimulus presentations.

During this inter-trial period, always 15 sec. in duration, the experimenter recorded (a) the length of time between the disappearance of the initial slide and the subject's first button press (latency); and, (b) the length of time between the subject's first and second button presses, that is, the length of time spent by the subject in looking at the stimulus (duration of viewing).

At the end of the 15 sec. inter-trial period, the experimenter pushed a button on Projector 1 to present the next slide and the above sequence of events was repeated.

Timer - Button pressing intervals in Experiment 1 were measured by two Hunter interval timers, Model 111, (Timers 1 and 2) placed on the table between the two slide projectors. Both timers were regulated to provide four dial readings in units of 0.01 sec., 0.1 sec., 1.0 and 10.0 sec. They were wired together so that cessation of timing by Timer 1 would automatically activate Timer 2. Timer 1 was also connected to Projector 1 and was activated by the termination of a projection from this machine. Timing ceased with the subject's first button press (latency) which had the effect of simultaneously activating Timer 2 and causing a slide to be projected by Projector 2. The second button press terminated both the timing period of Timer 2 (duration of viewing) and the slide presentation by the second projector. This sequence of events constituted one trial; recorded readings from the two timers provided the basic data for Experiment 1. After the 15 sec. inter-trial period, when the experimenter pressed the button on Projector 1 for another slide projection, the time indicators on both timers returned to zero and the next trial was initiated.

An automatic timing device was located on Timer 1 which could be manually set to regulate the duration of a slide projection from Projector 1. After the first trial, this timer was set by the examiner during the inter-trial period immediately before the initial slide projection.

Definition of One Trial. In order to more clearly describe the experimental procedure, a definition of one trial is presented below.

Each trial consisted of nine discrete events:

1) Initial slide exposure

2) Termination of initial slide exposure

3) Button press indicating desire to view second slide

4) Automatic second slide presentation

5) Button press indicating desire to terminate second slide presentation

6) Automatic termination of second slide presentation

7) Fifteen sec. inter-trial interval

8) Recording of latency and duration data

9) Manual setting of automatic timer for duration of initial slide exposure

Each subject was given a total of 16 trials. The first 4 trials were for the purpose of training the subjects on the experimental procedure. Only the data recorded for the remaining 12 trials was included in the statistical analysis.

During Experiment 1 the subject was seated facing the projection screen with his back to the table on which the projectors and timers were located. He was positioned between the two projectors and directly in front of the timers which were screened from his view by an upright board. The experimenter sat on the opposite side of the table directly behind the subject and facing the timer dials and the projection screen. This arrangement is more clearly illustrated in Figure 2.

Instructions to Subjects. When the subjects came to the experimental room the examiner attempted to put them at their ease and informed them of the experimental procedure. The following instructions were given to the subjects assigned to the "Same-Condition:"

> As you can see there are two slide projectors on this table. One of these projectors will be controlled by you. I am going to show you some slides each of which will appear on that screen (indicating screen) for either a brief or extended period of time. When the picture disappears you are to press the button on this hand control and the picture will re-appear and you can look at it for as long as you like. When the picture no longer interests you, press the button a second time

> and the picture will again disappear. In a few seconds I will show you another picture and you are to do the same as for the first picture.
>
> Before we begin I want to explain that the purpose of this experiment is to find out which pictures interest you the most. I assure you that this is not a memory test and you will not be asked any questions about the pictures either now or later. You are simply to look at them for as long as you find them interesting. Now, do you have any questions about what you are supposed to do?

Information and instructions given to subjects in the "Different-Condition" in Experiment 1 took the same form as those for the "Same-Condition" except that they were told that the first button press would result in the appearance of a picture differing from the preceding one.

Several of the subjects had some difficulty understanding the directions and the examiner repeated them with demonstrations until the subjects were satisfied that they would be able to carry out the task requirements.

Stimulus Materials:

Paper and Pencil Test of Closure - Shortly before the scheduled date for the beginning of this study, it was decided to include a test of closure ability on the testing procedure. Because no standardized test was immediately available, a closure test was constructed by the following method:

Sixteen illustrations of commonly observed objects were traced from a variety of sources and a certain amount of detail was then erased from each of the pictures. An attempt was made to arrange the incomplete pictures in the order of difficulty of identification. Sequence of difficulty was determined by the quantity of erased detail, the complexity of the depicted object, and by the experimenter's subjective judgment (see Appendix B).

In order to determine more precisely individual differences in the ability to identify the subject matter of these pictures, a time limit of

90 sec. was imposed for completion of the closure test. It was administered to all of the subjects in both Experiment I and Experiment II. Speed of closure was operationally defined as the number of correct responses (score) given by each subject.

After the slide presentation trials were concluded, the subjects in were asked to seat themselves at the table where the closure test was placed. They were told:

> This is not an intelligence test but merely a test of your ability to identify the subject of an incomplete picture. There are 16 pictures in this test and you will have 90 sec. to try to guess what they are. You can do them in any order. When I say "Start" lift up the first page and write your answers on the blank lines under the pictures.

When the subjects had either finished the test or used up the allotted time they were thanked for their cooperation and those who expressed curiosity about the experiment were told that they would receive a full explanation of the study when all the data had been collected.

Experimental Design. The primary design of Experiment 1 was comprised of two 4 X 2 X 3 factorials with two replicated and one non-replicated factor each. The variables of interest and their respective levels were:

Independent Variables

Duration of Initial Exposure - During the initial exposure period of each trial an incongruous stimulus configuration was presented to the subject for one of four different durations: (a) 0.1 sec.; (b) 0.2 sec.; (c) 5 sec.; and, (d) 10 sec. This represented the initial step in the sequence of steps which constituted one trial. For purposes of further reference, the 0.1 sec. and 0.2 sec. exposures will be designated as the "Brief Initial Exposure Period" and the 5 and 10 sec. exposures as the "Extended Exposure Period." The four training trials consisted of one each of these initial

exposure periods. Each of the four possible durations of initial exposure was employed in three of the 12 experimental trials.

Exposure Series 1. The order of presentation of the four durations of initial exposure for the 12 experimental trials was randomized by means of a table of random numbers. The order of presentation corresponded to the sequencing of the digits, 1, 2, 5, and 0 as they occurred for the first three times in a row of numbers in the table. The following exposure times were then substituted for the digits:

(a) 0.1 sec. exposure = 1

(b) 0.2 sec. exposure = 2

(c) 5.0 sec. exposure = 5

(d) 10.0 sec. exposure = 0

Half (n = 20) of the subjects in Experiment I received the order of durations of initial exposure in Exposure Series 1 as shown in Appendix C. Of these 20 subject, 10 had been assigned to the "Same-Condition" and then to the "Different-Condition."

Exposure Series 2. The order of presentation of the four durations of initial exposure for the 12 experimental trials in Exposure Series 2 was arranged to counterbalance Exposure Series 1. For each of the twelve trials a Brief Exposure Period was substituted for an Extended Exposure Period in Exposure Series 1 and an Extended Exposure Period was substituted for a Brief Exposure Period in the first series.

This was accomplished by the substitution of:

(a) 0.1 sec. exposure for a 10 sec. exposure

(b) 0.2 sec. exposure for a 5 sec. exposure

(c) 5.0 sec. exposure for a 0.2 sec. exposure

(d) 10.0 sec. exposure for a 0.1 sec. exposure

Half (n = 20) of the subjects in Experiment I received the order of durations of initial exposure in Exposure Series 2 as shown in Appendix C. As for Exposure Series 1, 10 of these subjects had been assigned to the "Same-Condition" and 10 to the "Different-Condition."

Additionally, half (n = 10) of the subjects presented with each exposure series were shown slides #1 - #4 (training trials) and slides #5 - #16 (experimental trials); the other half (n = 10) were shown slides #17 - #20 (training trials) and slides #21 - #32 (experimental trials). Thus, in both Exposure Series 1 and Exposure Series 2 each of the stimulus slides was presented for an equal number of Brief and Extended Exposure durations over the course of the experiment. Also, in both the "Same-Condition" and "Different-Condition" each of the slides was presented for an equal number of Brief and Extended Exposure durations.

Second Exposure Conditions - In the "Same-Condition," for half of the subjects (n = 10), both the Initial Exposure and the Second Exposure consisted of projections of slides #1 - #4 (training trials) and slides #5 - #16 (experimental trials). For the second half of the subjects (n = 10), both the Initial Exposure and the Second Exposure consisted of projections of slides #1 - #4 (training trials) and slides #5 - #16 (experimental trials). For the second half of the subjects (n = 10), both of the exposures consisted of projections of slides #17 - #20 (training trials) and slides #21 - #32 (experimental trials). (See Appendix D)

In the "Different-Condition," for half of the subjects (n = 10), Initial Exposure consisted of projections of slides #1 - #4 (training trials) and slides #5 - #16 (experimental trials); the Second Exposure consisted of projections of slides #17 - #20 (training trials) and slides #21 - #32 (experimental trials). For the second half of the subjects in

this condition (n = 10), the order was reversed with the Initial Exposure consisting of the projection of slides #17 - #20 (training trials) and slides #21 - #32 (experimental trials), the Second Exposure consisting of slides #1 - #4 (training trials) and #5 - #16 (experimental trials). By means of this procedure each stimulus slide was shown an equal number of times in both the Initial and Second Exposure periods (see Appendix D).

Dependent Variables

Latency of Response - Latency was defined as the elapsed time between the termination of the Initial Exposure period and the subject's button press for viewing the second slide. For each of the four initial exposure periods there were three trials for which latency of response was recorded. Latency was the measure of response which was utilized in the first statistical analysis. The three observations for each of the exposure periods were analysed individually and constituted the three levels of the non-replicated factor in the factorial design.

Duration of Second Exposure - Duration of the second exposure was defined as the timed interval between the subject's first button press for viewing the stimulus slide, his subsequent button press for stimulus cessation. For each of the four Initial Exposure periods there were three trials for which second exposure viewing time was recorded. Duration of Second Exposure was the response measure utilized in the second statistical analysis. The three observations for each of the Initial Exposure periods were analysed individually and constituted the three levels of the non-replicated factor in the second factorial design.

Closure

In Experiment I, an additional variable, closure ability was investigated by means of a separate factorial analysis of the data. Closure

ability was operationally defined by scores on the closure test previously described. Two 4 X 3 X 2 factorial designs, one for each of the two Second Exposure Conditions, were employed. These two designs were the same as those previously described except that two levels of closure ability were substituted for the Same and Different Exposure Conditions in the analysis. The two levels of closure were, (a) High Closure as reflected by a high score on the closure test; and (b) Low Closure as reflected by a low score on the test. A high score on the closure test was defined in terms of a median split. That is, in both the Same and Different Exposure Conditions, the High Closure group consisted of those subjects who obtained scores above the median. Conversely, the Low Closure group consisted of those subjects who obtained scores below the median. Median scores were disregarded for purposes of this analysis. Of the subjects tested in the Same Exposure Condition, eight achieved scores above the median (10) obtained by this group and eight scored below the median. Of the subjects tested in the Different Exposure Condition, seven subjects earned scores above the group median (9) and seven scored below the median. Therefore, the analysis of closure ability was comprised of data obtained from 30 subjects. Sixteen of these subjects were in the Same and 14 were in the Different Exposure Condition group, half of the subjects on both Exposure Conditions having earned a score on the closure test either above or below the median for their respective group.

EXPERIMENT II

Experiment II was included in the present study in order to reduce possible ambiguity in the interpretation of the latency data obtained in Experiment I. That is, it was speculated that if differences between latencies in the "Same-Condition" and "Different-Condition" should occur

as predicted by the hypotheses, the choice of viewing a slide either similar or dissimilar to the one seen in the initial exposure would clarify the motivational factors involved.

Projector - Only one slide projector was used in Experiment II. As in Experiment I, the experimenter pressed one button on the machine to present the initial slide. The length of presentation was controlled by an automatic timer. The projector was also equipped with a second button which, when pressed, caused the carousel to back up so that the slide which had been projected by the initial button press was returned to the pre-presentation position. Subsequent pressing of the first button resulted in a second presentation of the slide originally displayed.

A hand control, operated by the subject, was equipped with two buttons and was connected by an extension cord to two small light bulbs, one red and one white, located on a panel placed behind the upright board on the same table as the projector. The subject's finger pressure on the first button caused the red bulb to light up; pressure on the second button caused the white one to light. When finger pressure was removed from either button, the corresponding light was extinguished.

These two lights served as signals from the subject for second stimulus slide selection and also for termination of projection. That is, finger pressure on the first button signalled the choice of viewing the same slide as shown in the initial projection; pressure on the second button signalled the choice of viewing a slide that was different than the one initially shown. As long as either button was in the depressed position, lighting the corresponding bulb, the chosen slide was projected on the screen. When finger pressure was removed and the light extinguished, the slide projector was terminated by the experimenter.

In order to most closely approximate the conditions in Experiment 1, the arrangement of equipment and seating position of both the subject and experimenter were identical to those of the first experiment except that the hand control was not attached to the equipment but to a wooden panel placed on the table directly in front of the experimenter (see Figure 3).

Definition of One Trial. In order to more clearly describe the experimental procedures, a definition of one trial is presented below.

Each trial consisted of nine discrete events:

1) Initial slide exposure
2) Termination of initial slide exposure
3) Button press indicating choice of viewing same or different slide
4) Second slide presentation by the experimenter
5) Button press indicating desire to terminate second slide presentation
6) Termination of second slide presentation by experimenter
7) Fifteen second inter-trial interval
8) Recording of same or different choice data
9) Manual setting of automatic timer for duration of initial slide exposure

Each subject was given a total of 16 trials. The first four trials were used for training the subjects on the experimental procedure. The data recorded for the remaining 12 trials was included in the statistical analysis. Due to technical complications involved, neither latency nor duration data was recorded for Experiment II.

Instructions to Subjects. As for Experiment I, when the subject came to the experimental room they were greeted by the examiner who informed them of the experimental procedure. Instructions to the subjects took the following form:

> I am going to show you some slides each of which will appear on the screen for either a brief or extended

> period of time. When the picture disappears, you are to press this button (indicating first button) on this hand control if you wish to see the picture again. When you press the button the picture will re-appear and will remain on the screen for as long as you keep the button depressed. When the picture no longer interests you, release the button and the picture will disappear. On the other hand, after the first picture disappears, if you wish to see a different picture, press this other button (indicating second button) and keep it depressed for as long as you wish to see the picture. When you release the button the picture will disappear. Then, in a few seconds I will show you another picture and you are to again indicate your choice of the same or a different picture by pressing the appropriate button.

The subjects in this experiment were also reassured that they would not, at any time, be asked any questions about the slides. After the slide presentations were concluded, the closure test was administered. Procedure and instructions to the subject for this test were identical to those of Experiment I.

Experimental Design. The design of Experiment II was comprised of a 4 X 2 factorial with one replicated and one non-replicated factor.

Independent Variable

Duration of Initial Exposure - The independent variable investigated in Experiment II was the duration of the initial stimulus slide presentation which consisted of one each of the four possible exposure durations (0.1 sec., 0.2 sec., 5 sec., and 10 sec.) as described in Experiment I.

Dependent Variable

Second Exposure Selection - The dependent variable was represented by the subject's choice of either the Same or Different Second Exposure Condition immediately after viewing the stimulus slide during the Initial Exposure. As previously described, when the subject pressed the first button on his hand control, causing the red bulb to light, the experimenter projected the same slide as shown in the Initial Exposure Period. This presentation was subsequently terminated by the experimenter when the button was released

causing the light to extinguish. Termination of a slide presentation occurred when the experimenter pressed the forward button the the projector which moved a cardboard slide into projecting position resulting in a darkened screen. If, on the other hand, the subject pressed the second button, causing the white bulb to light, the experimenter projected a slide differing from the one shown in the Initial Exposure. Duration of Second Exposure viewing time in both the Same and Different Conditions was determined by the length of time during which the subject kept the button depressed causing the bulb to remain alight.

When the subject indicated that he wished to be re-exposed to the slide viewed during the Initial Exposure, the experimenter reversed the carousel and re-projected the same slide. When the subject indicated that he wished to view a different slide, the experimenter pressed the forward button on the projector which moved the next slide into projection. Consequently, although each subject was given sixteen trials, including four training trials, the total number of different stimulus slides shown was not the same for every subject.

Ten students, six male and four female, served as subjects in Experiment II and their choice of viewing a slide, identical to, or different from that viewed in the Initial Exposure, constituted the basic data for this part of the study.

Summary. The basic data for this research consisted of 24 observations for each of the 40 subjects in Experiment I. Twelve of these observations represented latency readings and the other 12, duration readings. Thus there were a total of 480 observations in Experiment I. Additionally, 40 scores were obtained on the closure test. With respect to Experiment II, there were 12 observations recorded for each of the 10 subjects for a total of

120 observations. Nine scores were obtained on the closure test. Unfortunately, one of the closure test results in Experiment II could not be included in the data analysis because it was discovered that one of the subjects had inadvertantly skipped a page of the test.

RESULTS

Latency Data

The first major analysis of the basic data was of the response latencies following each of the four Initial Exposure Periods for the 40 participating subjects in Experiment I. The mean latencies for both the Same and Different Second Exposure Conditions are presented in Table 1. The data were analyzed by the complete analysis of variance for a factorial experiment. This analysis is shown in Table 2.

Main Effects

Second Exposure Conditions - The main effect of "Same-Condition" and "Different-Condition" was highly significant. The mean latency scores of the 20 subjects in the "Different-Condition" were significantly greater than the mean latencies of the 20 subjects in the "Same-Condition" when summed over the four Initial Exposure Periods.

Initial Exposure Periods - The main effect of Initial Exposure Periods was also highly significant. The mean latencies of the 40 subjects in both the Same and Different Conditions were greater for the Brief Initial Exposure Period (0.1 sec. and 0.2 sec.) than for the Extended Initial Exposure (5 secs. and 10 secs.).

Latency Scores - The inter-trial variation in latency scores was not significant. Therefore, it can be concluded that total differences in individual latency scores were not significantly influenced by particular stimulus slides shown during the Initial Exposure Periods.

Interaction Effects

Second Exposure Condition x Initial Exposure Periods - There was a significant two-way interaction between Second Exposure Condition and Initial Exposure Periods. That is, the mean latency differences between the Same

and Different Second Exposures were significantly greater in the Brief than in the Extended Initial Exposure. This two-way interaction is summarized in Table 3. None of the other possible interaction effects approached significance in this analysis.

Duration Data

The second major analysis of data in this experiment utilized the three recorded duration-of-viewing scores obtained after each of the four Initial Exposure Periods. The means of these scores for both the Same and Different Second Exposure Conditions are presented in Table 4. The complete analysis of variance for the data is shown in Table 5.

Main Effects

Second Exposure Condition - The main effect of Same or Different Second Exposure Condition was not significant. Although there was a substantial difference of 3.57 seconds between the mean duration scores, this difference failed to reach significance due to the large amount of inter-subject variance as evident in the range of duration scores shown in Table 6.

Main Effects

Initial Exposure Periods - The main effect of Initial Exposure Periods was significant. The mean duration scores summed over all subjects in both the "Same-Condition" and "Different-Condition" were greater in the Brief Exposure than in the Extended Exposure.

Duration Scores - Although there was considerable inter-trial variation in duration scores over all of the experimental conditions, this variability was non-significant. In spite of the fact that mean viewing times for particular stimulus slides in the "Different-Condition" ranged from 3.85 to 8.40 secs., it is reasonable to assume that inter-trial variance did not influence the experimental results in any systematic way.

Interaction Effects

Second Exposure Condition x Initial Exposure Periods - As would be expected, there was a highly significant two-way interaction between Second Exposure Conditions and Initial Exposure Periods. Table 7 shows that the significant main effect of Exposure Periods was carried by the duration scores of the subject in the "Same-Condition." No other significant interactions were obtained in this analysis.

Although there were certain similarities in the results of the two analyses of variance, it is important to note the latency and duration scores were independent measures. The calculated correlation coefficient for latency and duration measures in the "Same-Condition" was 0.07. Similarly, the coefficient of correlation for these measures in the "Different-Condition" was estimated at 0.05.

Closure Test

The number of correct identifications of the 16 incomplete figures in the closure test constituted the individual scores on this test. Although an attempt was made to arrange the test items in order of difficulty, the data show that aim was not entirely attained. Table 8 shows the number of correct responses for the specific items in their presented order. As is evident in the table, #6 proved to be unexpectedly difficult whereas identification of figure #14 proved to be easier than anticipated.

The 49 closure scores ranged from 2 - 14 out of a possible score of 16. The mean score for the distribution was 9.5 and the median score was 10. Because the scores 8, 10 and 11 each occurred eight times, no modal value was obtained. The frequency distribution for the obtained scores is presented in Table 9.

The mean of the closure scores obtained by the 20 subjects in the

"Same-Condition" was 9.5 and the median score was 9. The mean closure of the 20 subjects on the "Different-Condition" was 9.85 and the median score was 10. Eight of the subjects in the "Same-Condition" obtained scores above the median score of 9 for this Condition and eight subjects obtained scores below the median. Seven of the subjects in the "Different-Condition" obtained scores above the median score of 9 for this Condition and seven subjects obtained scores below the median. Therefore, when subjects in each Condition were assigned to the High or Low Closure classification, the closure scores in the "Different-Condition" were slightly elevated over scores in the "Same-Condition." The means of the 30 closure scores for the subjects in the High and Low Closure categories for both the Same and Different Second Exposure Conditions are shown in Table 10.

The first investigation of possible Closure effects utilized the latency scores of the 16 subjects in the "Same-Condition" who had obtained scores either above or below the median on the Closure Test. These means were examined over the four levels of the Initial Exposure Period as shown in Table 11.

The data were analyzed by the complete analysis of variance for a factorial experiment as shown in Table 12.

Main Effects

Closure - The main effect of Closure was highly significant. Subjects who had obtained high scores on the closure test were found to have significantly longer latencies than low scoring subjects when the latency means were summed over the four Initial Exposure Periods.

Initial Exposure Periods - The main effect of Initial Exposure was not significant. There was no systematic tendency for latencies to differ significantly over the Brief and Extended Exposure Periods.

Latency Scores - The inter-trial variance for a particular experimental condition was non-significant.

Interaction Effects

None of the interactions were significant.

The second investigation of possible Closure effects utilized the duration scores of the 16 subjects in the "Same-Condition" included in the previous analysis. The means of these duration scores for the four levels of the Initial Exposure Period are shown in Table 13.

The data were analyzed by the complete analysis of variance as shown in Table 14.

Main Effects

Closure - The main effect of Closure was not significant. Although there appeared to be a consistent tendency for subjects in the High Closure Condition to have shorter duration scores than subjects in the Low losure Condition, this effect failed to attain significance due to the large inter-trial variance.

Initial Exposure Periods - The main effect of Exposure Periods was significant. As would be expected, subjects in both Closure Conditions had longer duration scores in the Brief than in the Extended Exposure Period.

Duration Scores - The inter-trial variation among the three scores obtained in each condition was not significant.

Interaction Effects

None of the interaction effects was significant.

The third investigation of closure effects utilized the latency scores of the 14 subjects in the "Different-Condition" who had obtained scores either above or below the median on the closure test. These means were examined over the four levels of the Initial Exposure Period as shown in Table 15.

The data were analyzed by the complete analysis of variance for a factorial experiment as shown in Table 16.

Main Effects

Closure - The main effect of Closure was not significant.

Initial Exposure Periods - The main effect of Exposure Periods was highly significant and corresponds to the finding in the first analysis of the latency data for the "Different-Condition."

Latency Scores - The main effect of the three latency scores was not significant.

Interaction Effects

None of the interaction effects was significant.

The fourth investigation of possible Closure effects utilized the duration scores of the 14 subjects in the "Different-Condition" included in the previous analysis. The means of these duration scores for the four levels of the Initial Exposure Period are shown in Table 17.

The data were analyzed by the complete analysis of variance for a factorial experiment. This analysis is shown in Table 18.

Main Effects

None of the main effects was significant.

Interaction Effects

Closure x Initial Exposure Periods - The interaction between Closure and Exposure Periods was significant. It was an unexpected finding that the mean duration scores of the subjects in the Low Closure

Main Effects

None of the main effects was significant.

Interaction Effects

Closure x Initial Exposure Periods - The interaction between Closure and Exposure Periods was significant. It was an unexpected finding that the mean duration scores of the subjects in the Low Closure Condition varied over the four Exposure Periods to a significantly greater extent than did the mean scores of the High Closure subjects. This effect was carried by the comparatively high scores of the Low Closure Subjects in the 0.1 sec. and 5 sec. Initial Exposure Periods.

No other interaction effects was significant.

An examination of the latency data for the two levels of Closure revealed an interesting discrepancy between the means of High Closure and Low Closure subjects with respect to the Same and Different Exposure Conditions. This difference was particularly pronounced in the Brief Initial Exposure Periods but also evident in the Extended Periods. The combined 0.1 sec. and 0.2 sec. means of the Initial Exposure Period are shown in Table 19 and the combined 5 sec. and 10 sec. means are shown in Table 20.

The fifth statistical investigation of the effects Closure was the analysis of variance carried out on the data of Table 19. The summary of this analysis is presented in Table 21.

Main Effects

Exposure Condition - The main effect of Same or Different Exposure Condition was highly significant and corresponds to the significant effect in the first latency analysis (see Table 2). That is, for all of the subjects, latencies were longer in the "Different-Condition" than in the "Same-Condition."

Closure - The main effect of Closure was not significant.

Interaction Effect

A x B - The two-way interaction between Second Exposure Condition and Closure was significant. Subjects in the High Closure Condition obtained significantly higher latency scores than subjects in the Low Closure Condition with respect to the "Same-Condition" and significantly lower scores with respect to the "Different-Condition." This interaction is graphically illustrated in Figure 1.

Experiment II

The data obtained from the 10 subjects in Experiment II consisted of their choice, for a particular trial, of either the Same or Different Second Exposure for each of the four levels of Initial Exposure. The means of this choice data are presented in Table 22.

The summary of the analysis of variance for the data in Table 22 is shown in Table 23.

Main Effects

Condition Choice - The main effect of choice of Same or Different Second Exposure was highly significant. Over the four levels of Initial Exposure the subjects chose to view a different stimulus slide significantly more often than they chose to view the slide to which they had been previously exposed.

Exposure Periods - The variance for the four levels of Initial Exposure was necessarily zero because the choice was a dichotomous one and, therefore, inversely reciprocal.

Interaction Effect

A x B - The two-way interaction between Condition Choice and Exposure Periods was highly significant. When subjects were shown the stimulus slides in the Brief Initial Exposure Periods they tended to choose to view the same slides

in the Second Exposure Periods. Conversely, when they were shown the stimulus slides for the Extended Exposure Periods the subjects tended to choose to view different stimulus slides in the Second Exposure Condition. This two-way interaction is graphically illustrated in Figure 2.

DISCUSSION

The primary objective of this chapter will be to interpret the latency and duration data of Experiment I and the choice data of Experiment II in terms of the hypotheses derived from the theories of Fowler (1967) and Berlyne (1963).

Applicability of Fowler's Single Theory of Exploration:

Latency Data - The statistical findings of the present study failed to confirm the major hypothesis derived from Fowler's theoretical position discussed earlier. Based upon the assumption that some increment of stimulus satiation would develop as a linear function of time of exposure during the Initial Exposure Period, it was hypothesized that latency measures would reflect a stronger tendency in subjects to respond more quickly with a button press for further stimulus viewing in the Different than in the Same Second Exposure Condition. However, contrary to this expectation, this tendency was significantly stronger in the "Same-Condition" than in the "Different-Condition." That is, over all of the four Initial Exposure Periods, latencies were shorter when the subjects' responses for the second stimulus slide presentation led to re-exposure to the same stimulus than when the responses resulted in exposure to a different slide (see Table 1).

Another expectation arising from Fowler's postulated drive-inducing effects of stimulus satiation was that latencies in the "Same-Condition" would tend to be shorter in the Brief Initial Exposure trials than in the Extended Initial Exposure trials. Because the quantity of satiation generated over time in the Briefer Initial Exposure would be relatively small, it would follow that the subjects would be less reluctant to view the same stimulus for a second time. The data do not support this conclusion.

The slight difference in latencies between the two Initial Exposure Periods in the "Same-Condition" was in the direction opposite to the one predicted on the basis of Fowler's theory.

On the other hand, the results obtained in the "Different-Condition" conform to predictions arising from Fowler's theory. The observed difference between the longer latencies in the Brief Initial Exposure Period and the shorter latencies in the Extended Exposure Period can be accounted for in terms of the greater amount of stimulus satiation accruing in the Extended Exposure Period as evidenced in the tendency to respond more quickly for a change in stimulation immediately following the lengthier exposure.

Duration Data - An unexpected finding of this study was that Second Exposure stimulus viewing time, averaged over the four Initial Exposure Periods, was not significantly greater in the Different than in the Same Condition (see Table 4). This result, or lack of one, is strongly inconsistent with Fowler's position. In his formulation duration of viewing time should be a positive function of Drive, which Fowler operationally defined as a function of time of exposure to an unchanging stimulus (T_e), and also of the magnitude of the stimulus change (K) which was made contingent upon the instrumental response for change. Therefore, Fowler would predict that subjects in the "Different-Condition" would spend significantly more time viewing the stimulus slides in the Second Exposure phase than subjects in the "Same-Condition" because these slides would tend to reduce their need for stimulus change. His formulation provides no rationale for supposing that subjects in the "Same-Condition" would desire to be re-exposed, for any appreciable length of time, to the same stimulus slides that were previously viewed in the Initial Exposure Periods. Since we are limited by our measurements to

interpreting relative performance differences between "Same" and "Different" conditions, the breakdown in Fowler's model is particularly noticeable in the difference in duration of viewing under the 0.2 sec. Initial Exposure Period.

The significant two-way interaction between Second Exposure Conditions and Initial Exposure Periods (see Table 7) can be readily explained in terms of Fowler's theory. In fact, this interaction would be predicted: i.e., that duration of viewing time would increase with increasing initial exposure in the "Different-Condition" and that, conversely, duration would decrease with increasing initial exposure in the "Same-Condition." With the exception of the reversal of the expected values under the 0.2 sec. Initial Exposure Period the significance of the interaction certifies just such a result.

Choice Data - The choice data from Experiment II parallel the data in Experiment I and, perhaps, provide an even clearer picture of the adequacies and inadequacies of Fowler's theory. The most significant finding in Experiment II was that the subjects demonstrated an overall tendency to choose to view a stimulus slide different from the one shown to them in the Initial Exposure (see Table 22). Clearly, this result conforms to expectations based on Fowler's formulation. However, this tendency was reversed in the Brief Initial Exposure trials. The reversal was particularly evident following the 0.1 sec. Initial Exposure Period when the subjects chose to be re-exposed to the same stimulus slide on 73.3% of the trials. This result presents a real difficulty with respect to interpretation in terms of Fowler's concept of stimulus satiation. His formulation specifies that some increment of satiation would have developed during the Initial Exposure Period however brief the time of exposure may have been. Consequently, his

theory does not provide for any circumstances in which subjects would choose to be immediately re-exposed to a stimulus.

With respect to some of the major findings of the present study, evaluation of the predictive and explanatory efficacy of Fowler's theory leads to the conclusion that his formulation as expressed in the equation $E = H \times (D \times K)$ is an incomplete one. It presents particular problems for an accounting of the latency, duration and choice data obtained in the Brief Initial Exposure Periods. Further discussion of Fowler's formulation will be postponed until later in the chapter.

<u>Applicability of Berlyne's Two Factor Theory of Exploration</u>:

<u>Latency Data</u> - The obtained data more readily lends itself to explanation in terms of Berlyne's onceptualizations. The difference between the shorter latencies in the Same Second Exposure Condition and the longer latencies in the Different Second Exposure Condition can be interpreted as arising from the tendency to reduce perceptual curiosity through identification of the component elements of the stimulus slides. Subjects in the "Same-Condition" would anticipate a resolution of the conflict generated by the incongruous features of the stimuli and the drive to reduce perceptual conflict would result in shorter latencies in this Condition. On the other hand, subjects in the "Different-Condition" could anticipate no such reduction of conflict. Therefore, it might be expected that they would tend to prolong opportunity for symbolic recall of the stimulus elements in an attempt to diminish the disturbance associated with perceptual conflict. This prolongation of the symbolic representation would have the effects of retarding the response for the viewing of a different stimulus slide.

The foregoing explanation is particularly relevant with respect to the two-way interaction between the longer latencies in the Brief and the shorter latencies in the Extended Initial Exposure Periods obtained in the "Different-

Condition." In the Extended Exposure Periods it could be assumed that the subjects had sufficient opportunity to resolve most, if not all, perceptual conflict during their relatively lengthy exposure to the conflicting informational elements of the incongruous stimuli. Subjects in the Brief Initial Exposure Period, however, would have had more limited access to the information due to the brevity of the first exposure. Therefore, it would follow that these subjects would have a great deal more unresolved conflict which would be reflected in longer response latencies.

Duration Data - The duration data results are also more easily interpreted within the context of Berlyne's theory. However, the theory has some difficulty dealing with the fact that subjects in the "Different-Condition" did not view the stimulus slides in the Second Exposure for a significantly greater length of time than subjects in the "Same-Condition." If the motivation for stimulus viewing in the Second Exposure was merely the resolution of perceptual conflict it would be expected that viewing time would be significantly less in the "Same-Condition" than in the "Different-Condition" where both conflict arousal and conflict resolution would occur during the Second Exposure phase of every trial.

However, reduction of perceptual conflict may not have been the sole objective of a considerable number of subjects in the "Same-Condition." By design, the intrinsic value of the stimulus slides for the subject was not great and the nature of the experimental task (button pressing) was undemanding. Therefore, it might be speculated that arousal was at a relatively low level for many of the subjects. This may have been the case particularly for subjects in the "Same-Condition" who were exposed to half the number of conflict inducing stimuli than were the subjects in the "Different-Condition." Subjects experiencing low arousal, or boredom, could alter this mildly

aversive situation in two ways: (1) They could reduce stimulus viewing time to the minimum requirement consistent with conflict resolution, individual reaction times and the physical limitations imposed by the experimental equipment thus terminating the experiment as quickly as possible; or (2) They could engage in cognitive behavior which would heighten the interest value of the stimuli, and consequently, raise arousal level. Evidence to support this interpretation is provided by the large inter-subject variance mean square as shown in Table 5. Further, it is interesting to note that, at the conclusion of the experiment, subjects in the "Same-Condition" who were asked why they had chosen re-exposure to the same stimulus slides for comparatively lengthy periods of time following Extended Exposure Period trials, replied that it had been interesting to visually examine the pictures in terms of detail or of compositional aspects. Two of the subjects in this condition reported that during the Extended Exposure trials they had tried to memorize as many features of the slides as possible in the Initial Exposure phase and then had checked the accuracy of their recollections during the Second Exposure phase. It appears that some of the subjects, particularly those in the "Same-Condition," when placed in the position of having to view the stimulus slides for varying lengths of time, "made the best" of the situation by developing an artifactual interest in various aspects of the incongruous stimulus slides.

The significant difference between Second Exposure viewing durations with respect to the Brief and Extended Initial Exposure Periods was shown by the subjects in the "Same-Condition." This two-way interaction is readily explained in terms of Berlyne's theory. It would be reasonable to assume that the unresolved perceptual conflict occuring in the Brief Exposure Period would result in longer Second Exposure viewing time in order to resolve the

conflict through perceptual assimilation and organization of the incongruous stimulus elements. Presumably, in the Extended Initial Exposure, the subjects had time to reduce their conflict during the first exposure and the fact that stimulus viewing in the Second Exposure Period would no longer serve this purpose was reflected in shorter duration of viewing scores.

Choice Data - The results of Experiment II generally conform to predictions arising from Berlyne's theory (see Table 22). The finding that, over the four periods of Initial Exposure, the subjects chose to view a different rather than the same stimulus slide can perhaps best be interpreted with reference to the two-way interaction between the Initial Exposure Periods and the choice of Same or Different Second Exposure Condition. The significance of this interaction was primarily the result of the pronounced tendency of the subjects to choose to view the same stimulus after the 0.1 sec. Initial Exposure Period. Following the 0.2 sec. Initial Exposure Trials there was little difference between choice of same or different stimuli. Conversely, after all of the Extended Initial Exposure Period trials the subjects, with only two exceptions, chose to view a different stimulus slide. In terms of perceptual conflict, it might be surmised that due to the lesser amount of perceived relevant information during the .01 sec. Initial Exposure Period there was a great deal more unresolved conflict than with the 0.2 sec. Initial Exposure. Similarly, it would be reasonable to assume that, following both the 5 sec. and 10 sec. Exposure Periods, the perceived information would have been integrated and categorized resulting in either maximal reduction of perceptual conflict or complete conflict resolution.

Closure

It was hypothesized that speed of closure would reflect the ability to

perceptually organize visual material consisting of incomplete information in such a way that missing cues would be compensated for by the imposition of an identifiable structure. It was further speculated this ability to impose structure upon an ambiguous stimulus configuration would be associated with the perceptual efficiency required to resolve the conflict aroused by incongruous stimuli.

Because the closure test employed in the present study was not a standardized one, it could not be ascertained that scores on this test were comparable to those of tests utilized by previous investigators. However, the results of this experiment indicate that the specifically designed closure test discriminated among the subjects along the dimensions of some variable, or variables, involving visual perception.

Latency Data - One of the principal findings (see Table 12) with regard to closure was that, irrespective of the duration of the Initial Exposure Period, subjects in the "Same-Condition" who obtained high scores on the closure test tended to have longer latencies than the low scoring subjects. In fact, the significant overall difference between the longer latencies of the subjects in the "Different-Condition" and the shorter latencies of the subjects in the "Same-Condition" (see Table 1) was largely the effect of the relatively short latencies of the low closure scorers in the "Same-Condition." If we assume, as hypothesized, that these test scores were related to perceptual efficiency, this result lends itself to the conjecture that subjects who obtained low scores on the closure test experienced more perceptual conflict than high scorers and, consequently, a greater amount of subjective uncertainty with respect to identification of the subject matter of the stimulus slides. Therefore, it might be expected that they would be more highly motivated to reduce uncertainty by further exposure

to the incongruous slides. Their relatively high level of drive, or arousal, was subsequently reflected in shorter latency scores.

This interpretation is further supported by the finding of a two-way interaction between Closure and Second Exposure Condition for the combined means of the 0.1 sec. and 0.2 sec. Initial Exposure Periods (see Table 19). Although there was relatively little difference between the Same and Different Second Exposure Conditions for high closure scorers, this difference was considerable for the low scoring subjects. It seems likely that subjects who obtained low closure scores, having more perceptual conflict than high scorers in the "Same-Condition," were more highly motivated to resolve this conflict by further viewing of the same stimulus configuration. On the other hand, low scorers in the "Different-Condition" were inclined to have longer latencies because, in this condition, perceptual conflict would not be reduced by viewing a different stimulus. It might be speculated that, in the "Different-Condition," low scoring subjects were more apt to symbolically prolong the internal representation of the stimulus in order to obtain conflict reduction.

Duration Data - A curious finding of this study was that there was a significant two-way interaction between the duration scores of the high and low closure subjects with respect to Initial Exposure Periods in the "Different-Condition" (see Table 18). These viewing time differences were most evident in the relatively longer Second Exposure duration scores of the Low Closure subjects following the 0.1 second and 5 second Initial Exposure trials. The writer is at a loss to explain this finding, not only in terms of present theoretical considerations, but also on the basis of logical inference.

General Considerations

Response Measures - Because no positive correlation between latency and duration scores was obtained in this study it appears that these two measures reflected quite different motivational components of visual exploration. The latency results have most readily lent themselves to interpretation involving the drive, or arousal, engendered by exposure to a source of conflicting information. Somewhat paradoxically, latency scores were given a different interpretation in the "Same-Condition" than in the "Different-Condition." However, the dissimilarity between the Second Exposure Conditions lent itself to the suggestion that both low and high latency scores could be associated with a high level of drive. That is, short latencies following the Brief Initial Exposure Periods in the "Same-Condition" were interpreted as reflecting relatively high drive to reduce perceptual conflict through re-exposure to the same stimulus. Long latencies following the Brief Initial Periods in the "Different-Condition" were also interpreted as reflecting a relatively high drive to reduce perceptual conflict through prolongation of the symbolic representation of the stimulus. Thus, it was speculated that, utilizing the conceptualizations of Berlyne's (1965) theory, the drive toward conflict resolution might be either directed toward an external source of information or, conversely, internally directed in terms of symbolic cognitive activity.

Duration scores presented more difficulties with respect to interpretation in terms of drive directed toward conflict reduction than did latency scores. Although differences in duration scores were generally in the direction that would be predicted on the basis of Berlyne's theory, their lack of significance is most probably attributable to large individual differences. It appears that a number of confounding variables may have

affected duration scores. As previously noted, although the stimulus slides were not intended to have high intrinsic visual appeal, some of the subjects reported that they had found them to be interesting or even "entertaining." These subjects explained that they had initiated cognitive diversions in order to heighten the interest value of the experiment. Because of the nature of some of this reported behavior it would be expected to exert its greatest effect upon viewing time following the Extended Initial Exposure Periods in the "Same-Condition." In this situation it was possible for subjects to engage in a cognitive activity which utilized the first exposure for memorization and the second exposure for verification of accuracy of recall.

That same behavior, not directly related to the specific drive for conflict reduction, was taking place in the "Same-Condition" is suggested by the data contained in Table 24; which shows the total viewing time of the subjects summed over both the Initial Exposure Periods and the Second Exposure. Even allowing for the fact that, in the Extended Exposure Periods, five and ten seconds of the total viewing time was imposed upon the subject, voluntary viewing time in the Second Exposure was well above the maximum reaction time required for button pressing and stimulus termination.

Speculation regarding such diversive cognitive activity suggests that it may be important to investigate the personality variables associated with individual methods of coping with the low arousal value of a generally uninteresting task. It might be hypothesized that subjects who are externally oriented would react to the experimental assignment with boredom and would tend to escape from a mildly aversive situation as quickly as possible. Conversely, internally orientated subjects might tend to instigate some form of compensatory cognitive activity which would have the effect of prolonging

the experiment.

Another possible explanation of the variation in duration scores is that, in spite of the nature of their instructions, some of the subjects may have attempted to memorize the content of the stimulus slide presentations either because they anticipated later questioning regarding the subject matter of the slides or because of a spontaneous "set to remember." The effect of these variables was investigated by Greenberger, Woldman & Yourshaw (1967). They found that duration of viewing of incongruous, ambiguous and complex lantern slides was significantly affected by pre-test instructions regarding post-test questioning. Subjects who were told that they would have to answer questions about the stimulus material spent more time viewing the slides than subjects given an explanation regarding the requirements of the experimental task similar to the one used in the present experiment. On the other hand, Greenberger and her associates discovered by means of a post-test questionnaire, that seven of their ten subjects had formed expectations concerning the experiment that were not in accordance with the explanation provided for them. It was found that, although only three of the subjects had actually disbelieved the experimenter when she told them that they would not be asked any questions about the slides, nine of the subjects had engaged in behavior, such as labelling, that could be considered conducive to later remembering. These authors concluded that efforts to memorize may take place spontaneously over a variety of experimental conditions.

An additional explanation for the unexpectedly long duration scores in the Extended Initial Exposure Period is that subjects in the "Same-Condition" may not have believed the examiner's statement that they would be shown the same stimulus picture in both the Initial and Second Exposures and, therefore,

expecting to be tricked, they carefully examined the stimulus slide presented in the Second Exposure for some discrepancy which they might be expected to notice.

In conclusion, therefore, the findings of Greenberger et al. (1967), considered in conjunction with the results of the present study, cast serious doubt upon the usefulness of utilizing duration of viewing as a valid indicator of the strength of the specific drive to reduce perceptual conflict.

Response "Sets" - An interesting finding of this study was that subjects appeared to develop response "sets" with regard to latency. That is, it seemed that the subjects tended to maintain a relatively fixed tempo, or rate of button pressing for second stimulus exposure. This tendency was most evident in latency scores in the "Same-Condition." If, as assumed, the latency scores reflect drive, it would follow that the higher level of unreduced drive in the Brief Exposure Periods would be evidenced in shorter latencies than those obtained following in the Extended Exposure Periods. However, despite the fact that the results of Experiment II demonstrated a highly significant tendency of subjects to choose to view more Same stimulus slides after the Brief Initial Exposure and fewer slides after the Extended Initial Exposure, the small difference between Brief and Extended Initial latency scores in the Same Second Exposure Condition did not reflect these tendencies. Also, although the data of Experiment II clearly showed that the drive to view Same stimulus slides following the 0.1 sec. initial exposure was much greater than the drive to view the same slide after the 0.2 sec. initial exposure, the mean latencies in the "Same-Condition" of Experiment 1 were identical for both the Brief Initial Exposure Periods. Similarly, there was a negligible difference between the latencies in the two Brief Initial Exposure Periods in the "Different-Condition."

One explanation for the comparative uniformity of latency scores may involve the notion of a relatively stable "set" to respond at a certain rate. It is further speculated that this apparent regularity in rate of responding may be influenced by the latency rates established in the Brief Initial Exposure Periods when drive is presumably at its highest and that the latencies in the Extended Initial Exposure Periods may represent a "carry-over" effect.

There may also have been a response "set" associated with stimulus viewing time in the Second Exposure which would add another source of confounding with respect to the duration data and yet another possible explanation for failure to obtain significant differences in duration between the Brief and Extended Initial Exposure Periods in the "Same-Condition."

The relative uniformity of mean latency scores suggests that latency is not a sensitive measure of the drive to reduce perceptual conflict. Nevertheless, the obtained significant differences in latencies suggest they are more closely linked to Berlyne's concept of specific curiosity drive than are the duration scores.

Summary and Conclusions

This study was designed to investigate differential hypotheses derived from the theories of Fowler (1967) and Berlyne (1963; 1965). These theorists share the basic premise that only reductions in drive level are reinforcing. In addition, they both subscribe to the concept of a boredom drive which is generated when an organism is exposed to a relatively unchanging stimulus complex and is a function of the duration of exposure of monotonous stimulation. This boredom drive induces diversive exploration directed toward the introduction of stimulus change which serves to reduce the drive.

Hypotheses and expectations based on the motivational effects of relatively extended exposures to a stimulus (stimulus satiation) were identical for both theories. Major findings of the present study which provide support for the concept of diversive exploration were:

1) Following a relatively lengthy exposure to a stimulus, subjects responded more quickly for a change in stimulation than when the exposure had been relatively brief.

2a) Following a relatively lengthy exposure to a stimulus, subjects spent more time visually exploring a change in stimulation than when the exposure had been relatively brief.

2b) Following a relatively lengthy exposure to a stimulus, subjects spent relatively less time visually exploring this same stimulus than when the previous exposure had been relatively brief.

3) Following a lengthy exposure to a stimulus, given the choice, subjects responded for a change in stimulation rather than for re-exposure to the same stimulus.

Apart from the described similarities, there are two basic differences between the theories of Fowler and Berlyne. Whereas for Fowler all exploration is diversive, Berlyne's theory includes the additional concept of exploration induced by perceptual curiosity. Perceptual curiosity is aroused by a stimulus configuration possessing conflicting elements which stimultaneously instigate conflicting response tendencies in the organism. This curiosity drive elicits specific exploration directed toward further exposure to the same stimulus and is reduced by the emergence of a dominant tendency to respond.

Major findings of the present study which provide support for the concept of specific exploration were:

1) Following relatively brief exposure to a stimulus, subjects responded more quickly for re-exposure to the same stimulus than for a change in stimulation.

2) Following relatively brief exposure to a stimulus, given the choice, subjects preferred to be re-exposed to the same stimulus rather than to be exposed to a change in stimulation.

Neither of these two, very significant results, could be explained within the context of Fowler's formulation which does not make any provision for predicting that subjects would be more highly motivated to respond for re-exposure to the same stimulus than to respond for stimulus change.

The second basic difference between the theories of Fowler and Berlyne is that Fowler's theory does not take cognitive behavior into consideration. Selected findings of this study can most easily be interpreted in terms of the cognitive processes described by Berlyne such as the classification of stimuli by means of internal symbolic representation directed toward the identification and resolution of conflicting elements. Also, the significant findings regarding the effects of individual differences in speed of closure ability were interpretable with reference to Berlyne's cognitive concepts.

The principal conclusion of this study is that Fowler's attempt to explain all exploratory behavior within the context of diversive exploration has not been successful because the concept of stimulus satiation cannot adequately deal with the complexity of visual exploration in human beings. The findings of both Experiment I and Experiment II indicate that the motivation underlying exploratory activity not only varies between individuals but also from one situation to another. Therefore, human curiosity cannot be fully accounted for except by a theory such as Berlyne's which

incorporates within its framework, not only the concept of diversive exploration, but also of the specific exploration motivated by perceptual curiosity with its inferences regarding perceptual conflict and cognitive processes.

Table 1

The Latency Means of the 8 Treatment

	0.1 sec.	0.2 sec.	5 secs.	10 secs.	
Different	2.25	2.21	1.41	1.40	7.26
Same	1.09	1.09	1.01	1.02	4.22
Total	3.34	3.30	2.42	2.42	11.48
Differences	1.16	1.12	.40	.38	3.04

Table 2

Summary of the Analysis of Variance
(Latency)

	Source of Variation	Sum of Squares	d.f.	Square	F	p
A:	Exposure Condition	72.31	1	72.31	40.89	.01
	Subjects x A	67.20	38	1.77		
B:	Exposure Periods	26.09	3	8.70	36.69	.01
	A x B	18.32	3	6.10	25.75	.01
	Subjects x A x B	27.03	114	.24		
D:	Latency Scores	1.55	2	.77	2.88	
	A x C	.06	2	.03	.12	
	Subjects x A x C	20.49	76	.27		
	B x C	.50	6	.08	.48	
	A x B x C	.41	6	.07	.35	
	Subjects x A x B x C	44.71	228	.20		
	Total	278.68	479			

Table 3

The Two-Way Table of Latency
Means for the A x B Interaction

	Brief	Extended
Different	4.46	2.81
Same	2.18	2.03
Total	6.64	4.84
Difference	2.28	.78

Table 4

The Duration Means of the 8 Treatments

	0.1 sec.	0.2 sec.	5 secs.	10 secs.	
Different	6.33	5.91	6.54	6.51	25.30
Same	6.29	7.07	4.65	3.72	21.73
Total	12.62	12.98	11.19	10.23	47.03
Differences	.04	-1.16	1.89	2.79	3.57

Table 5

Summary of the Analysis of Variance
(Duration)

	Source of Variation	Sum of Squares	d.f.	Mean Square	F	p
A:	Exposure Condition	96.13	1	96.13	1.27	
	Subjects x A	2,877.87	38	75.73		
B:	Exposure Periods	144.28	3	48.09	6.22	.01
	A x B	279.55	3	93.18	12.06	.01
	Subjects x A x B	880.79	114	7.73		
C:	Duration Scores	30.51	2	15.25	2.52	
	A x C	5.72	2	2.86	.47	
	Subjects x A x C	459.12	76	6.04		
	B x C	24.50	6	4.08	.88	
	A x B x C	15.47	228	2.58	.56	
	Subjects x A x B x C	1,051.64	228	4.61		
	Total	5,865.58	479			

Table 6

Range of Duration Scores

	Brief Exposure	Extended Exposure
Different	1.95 - 16.89	2.31 - 19.70
Same	.99 - 21.25	.99 - 13.91

Table 7

The Two-Way Table of Duration
Means for the A x B Interaction

	Brief	Extended
Different	12.24	13.05
Same	13.36	8.37
Difference	-1.12	4.68

Table 8

Number of Correct Identifications
for Figures in the Closure Test

#1	#2	#3	#4	#5	#6	#7	#8
48	45	47	42	35	3	32	38

#9	#10	#11	#12	#13	#14	#15	#16
30	42	36	36	6	29	7	0

Table 9

The Frequency Distribution of Closure Scores

Score	Frequency
14	1
13	4
12	5
11	8
10	8
9	7
8	8
7	4
6	2
5	0
4	1
3	0
2	1

Table 10

Means of the Closure Scores

	High Closure	Low Closure
Different	11.86	7.71
	n = 7	n = 7
Same	11.50	7.37
	n = 8	n = 8
Difference	.36	.34

Table 11

The Latency Means of the
8 Treatments in the "Same-Condition"

	0.1 sec.	0.2 sec.	5 secs.	10 secs.	
High Closure	1.38	1.35	1.17	1.17	5.07
Low Closure	.87	.91	.90	.86	3.54
Total	2.25	2.26	2.07	2.03	8.61
Difference	.51	.44	.27	.31	1.53

Table 12

Summary of the Analysis of Variance
(Latency.. "Same-Condition")

	Source of Variation	Sum of Squares	d.f.	Mean Square	F	p
A:	Closure	7.03	1	7.03	13.07	.01
	Subjects x A	7.52	14	.54		
B:	Exposure Periods	.53	3	.18	1.67	
	A x B	.42	3	.14	1.32	
	Subjects x A x B	4.43	42	.10		
C:	Latency Scores	.45	2	.23	1.76	
	A x C	.25	2	.01	.10	
	Subjects x A x C	3.59	28	.13		
	B x C	.16	6	.03	.30	
	A x B x C	.91	6	.15	1.66	
	Subjects x A x B x C	7.70	84	.09		
	Total	32.77	191			

Table 13

The Duration Means of the
8 Treatments in the "Same-Condition"

	0.1 sec.	0.2 sec.	5 secs.	10 secs.	
High Closure	5.08	6.27	4.08	3.49	18.92
Low Closure	8.03	8.87	5.33	4.23	26.46
Total	13.11	15.14	9.41	7.72	45.38
Difference	-2.95	-2.60	-1.25	-.74	-7.54

Table 14

Summary of the Analysis of Variance
(Duration.. "Same-Condition")

	Source of Variation	Sum of Squares	d.f.	Mean Square	F	p
A:	Closure	167.25	1	167.25	1.57	
	Subjects x A	1,487.06	14	106.22		
B:	Exposure Periods	405.43	3	135.14	14.73	.01
	A x B	34.52	3	11.51	1.25	
	Subjects x A x B	385.21	42	9.17		
C:	Duration Scores	19.82	2	9.91	2.09	
	A x C	8.96	2	4.48	.94	
	Subjects x A x C	132.80	28	4.74		
	B x C	13.59	6	2.26	.40	
	A x B x C	22.01	6	3.67	.65	
	Subjects x A x B x C	472.37	84	5.62		
	Total	3,149.04	191			

Table 15

The Latency Means of the 8 Treatments
in the "Different-Condition"

	0.1 sec.	0.2 sec.	5 secs.	10 secs.	
High Closure	1.88	2.02	1.12	1.15	6.17
Low Closure	1.69	1.56	1.13	.98	5.36
Total	3.57	3.58	2.25	2.13	11.53
Difference	.19	.46	-.01	.17	.81

Table 16

Summary of the Analysis of Variance
(Latency.. "Different-Condition")

	Source of Variation	Sum of Squares	d.f.	Mean Square	F	p
A:	Closure	5.13	1	5.13	2.29	
	Subjects x A	26.85	12	2.24		
B:	Exposure Periods	33.00	3	11.00	26.17	.01
	A x B	1.31	3	.44	1.04	
	Subjects x A x B	15.13	36	.42		
C:	Latency Scores	.77	2	.38	1.01	
	A x C	1.32	2	.66	1.73	
	Subjects x A x C	9.14	24	.38		
	B x C	.61	6	.10	.74	
	A x B x C	.91	6	.15	1.11	
	Subjects x A x B x C	9.86	72	.14		
	Total	104.04	167			

Table 17

The Duration Means of the 8 Treatments
in the "Different-Condition"

	0.1 sec.	0.2 sec.	5 secs.	10 secs.	
High Closure	5.69	6.26	5.55	6.21	23.71
Low Closure	7.57	6.18	7.91	6.32	27.98
Total	13.26	12.44	13.46	12.53	51.69
Difference	-1.88	.08	-2.36	-0.11	-4.27

Table 18

Summary of the Analysis of Variance
(Duration.. "Different-Condition")

	Source of Variation	Sum of Squares	d.f.	Mean Square	F	p
A:	Closure	49.54	1	49.54	.60	
	Subjects x A	982.85	12	81.90		
B:	Exposure Periods	6.59	3	2.20	.40	
	A x B	52.78	3	17.59	3.14	.05
	Subjects x A x B	201.74	36	5.60		
C:	Duration Scores	24.62	2	12.31	1.45	
	A x C	11.37	2	5.69	.67	
	Subjects x A x C	203.61	24	8.48		
	B x C	23.49	6	3.91	.74	
	A x B x C	17.42	6	2.90	.55	
	Subjects x A x B x C	382.60	72	5.31		
	Total	1,956.62	167			

Table 19

Combined Means of the 2 Latencies
in the Brief Exposure Period for 4 Treatments

	"Same-Condition"	"Different-Condition"	
High Closure	1.36	1.95	3.31
Low Closure	.89	2.29	3.18
Total	2.25	4.24	6.49
Difference	.47	-.34	.13

Table 20

Combined Means of the 2 Latencies
in the Extended Exposure Period for 4 Treatments

	"Same-Condition"	"Different-Condition"	
High Closure	1.17	1.13	2.30
Low Closure	.87	1.45	2.32
Total	2.04	2.58	4.62
Difference	.30	-.32	-.02

Table 21

Summary of Analysis of Variance

Source of Variation	Sum of Squares	d.f.	Mean Square	F	p
A: Exposure Condition	8.02	1	8.02	34.21	<.01
B: Closure	.02	1	.02	.10	
A x B	1.29	1	1.29	5.50	<.05
Error	6.09	26	.23		
Total	15.42	29			

Table 22

The Means of Choices for Same or Different
for the 4 Initial Exposure Periods

	0.1 sec.	0.2 sec.	5 secs.	10 secs.	
Same	2.2	1.7	.2	o	4.1
Different	.8	1.3	2.8	3.0	7.9
Differences	1.4	.4	-2.6	-3.0	-3.8

Table 23

Summary of Analysis of Variance

Source of Variation	Sum of Squares	d.f.	Mean Square	F	p
A: Condition Choice	18.05	1	18.05	62.24	<.01
B: Exposure Periods	.00	3	.00		
A x B	71.35	3	23.78	82.00	<.01
Error	20.60	72	.29		
Total	110.00	79			

Table 24

The Total Duration Means of the 8 Treatments

	0.1 sec.	0.2 sec.	5 secs.	10 secs.
Different	6.33	5.91	6.54	6.51
Same	6.39	7.27	9.65	13.72

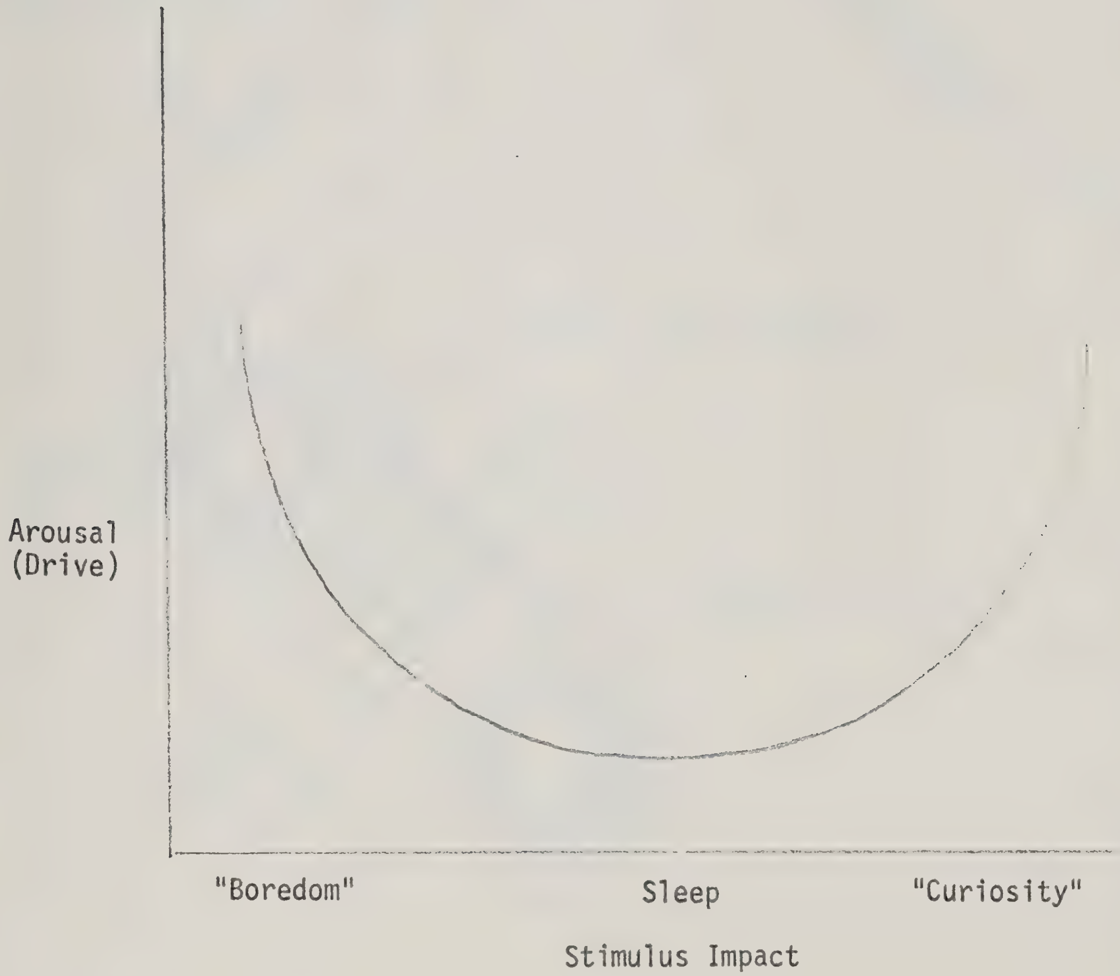


Figure 1

Diagram of the Relationship Between

Arousal and Stimulus Impact (Berlyne, 1963)

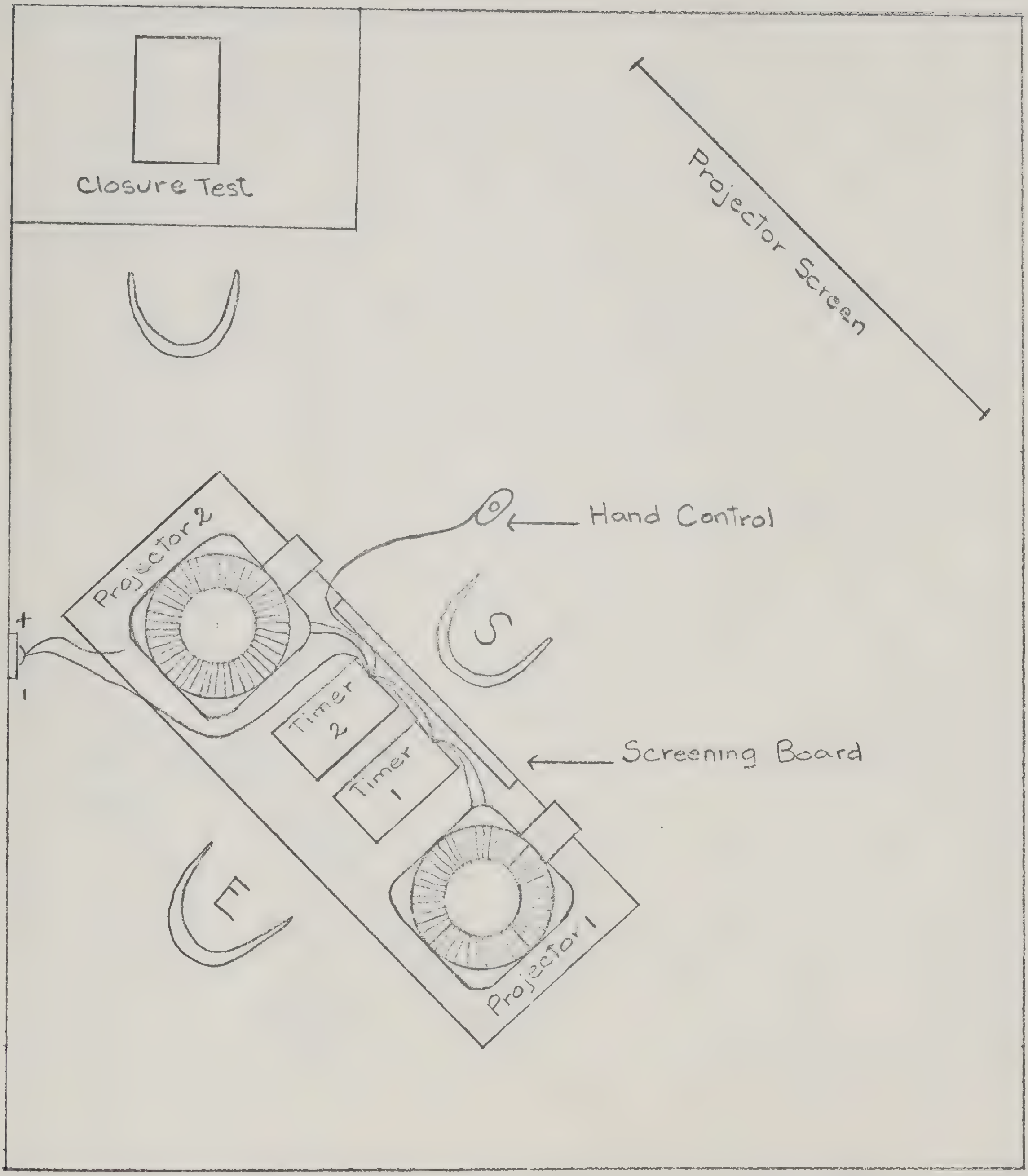


Figure 2

Experiment I

Diagram of Testing Room

(Top View)

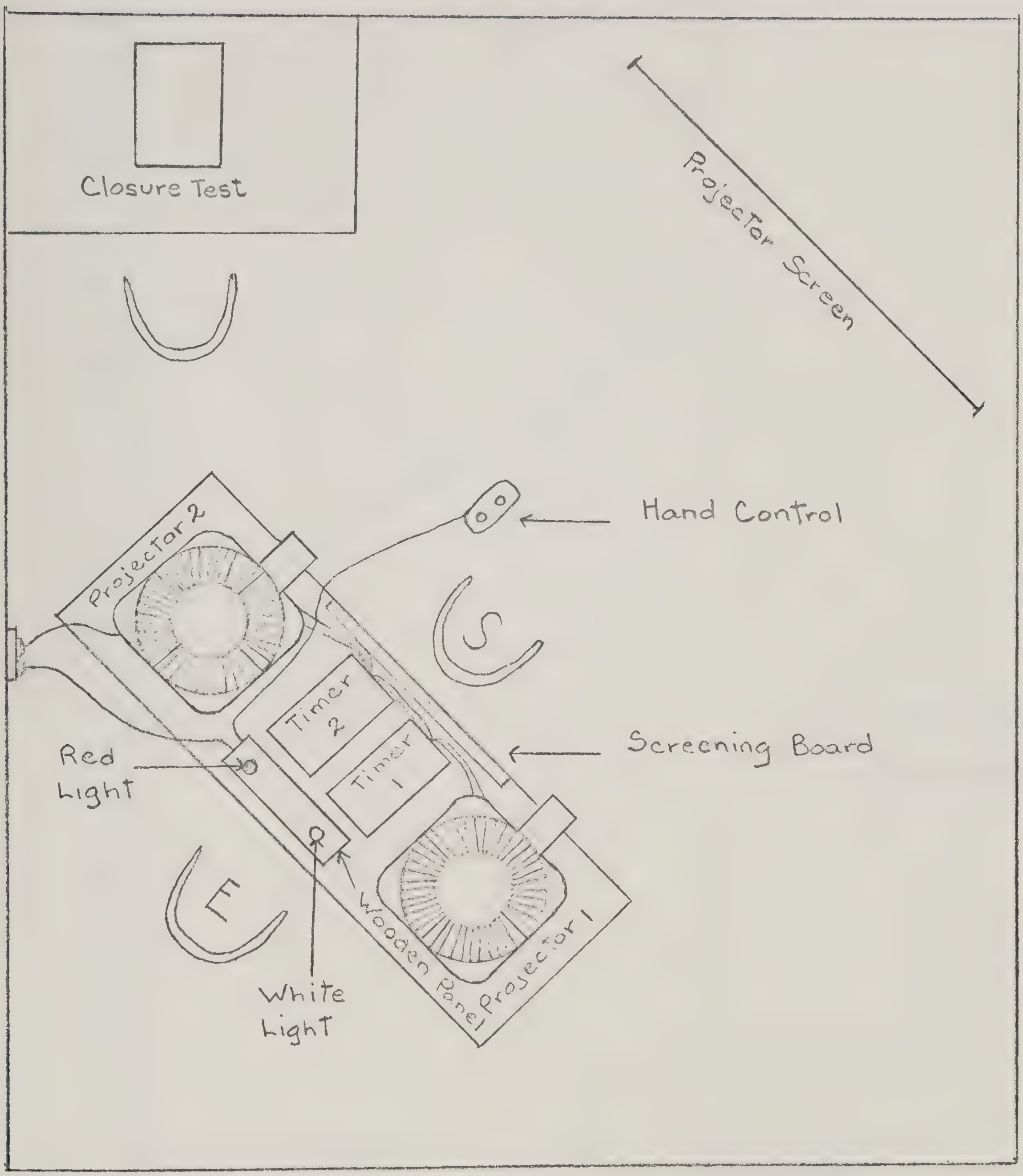


Figure 3

Experiment II

Diagram of Testing Room

(Top View)

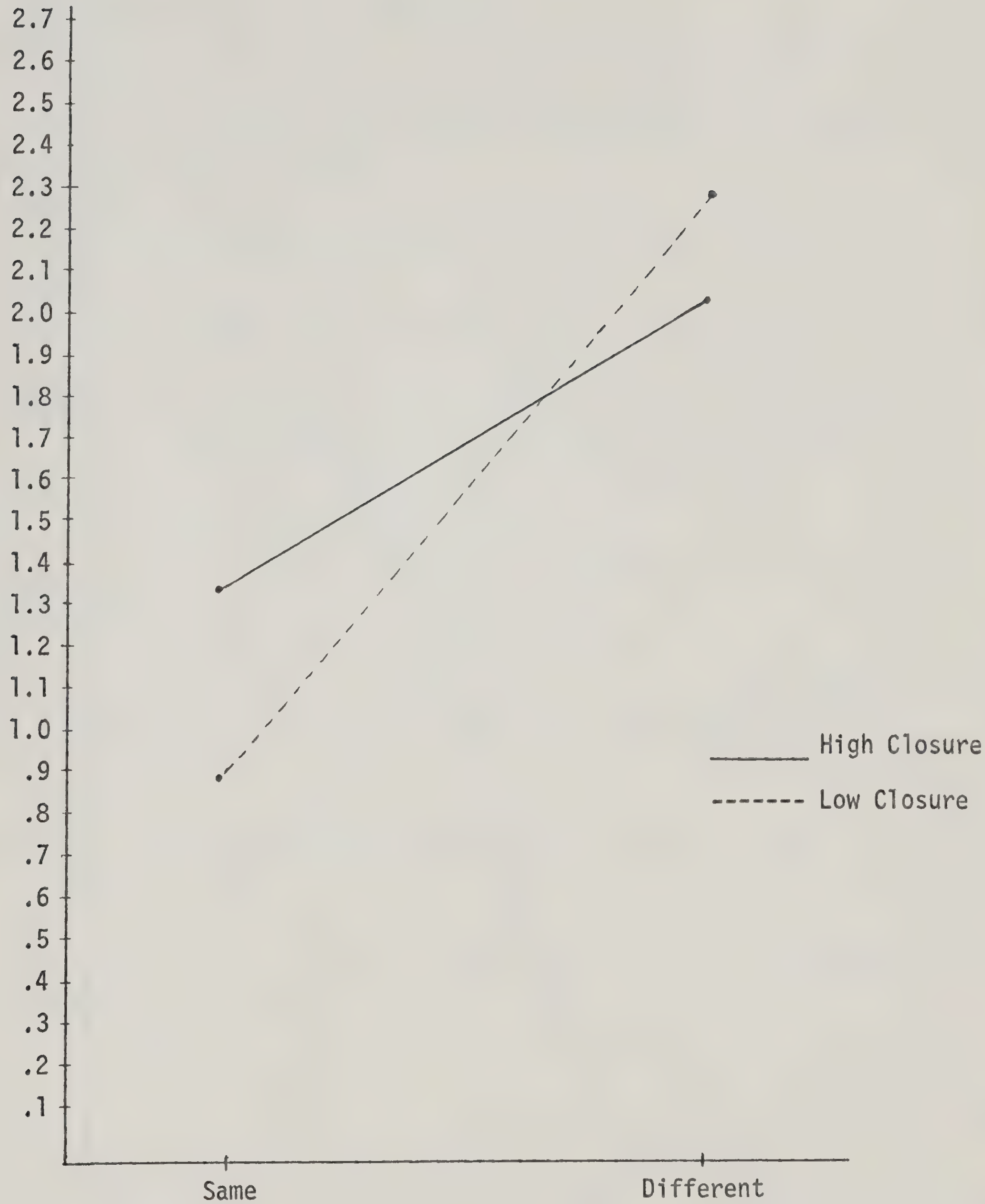


Figure 4. Interaction of Means of 2 levels of Closure ability with 2 levels of Second Exposure Conditions

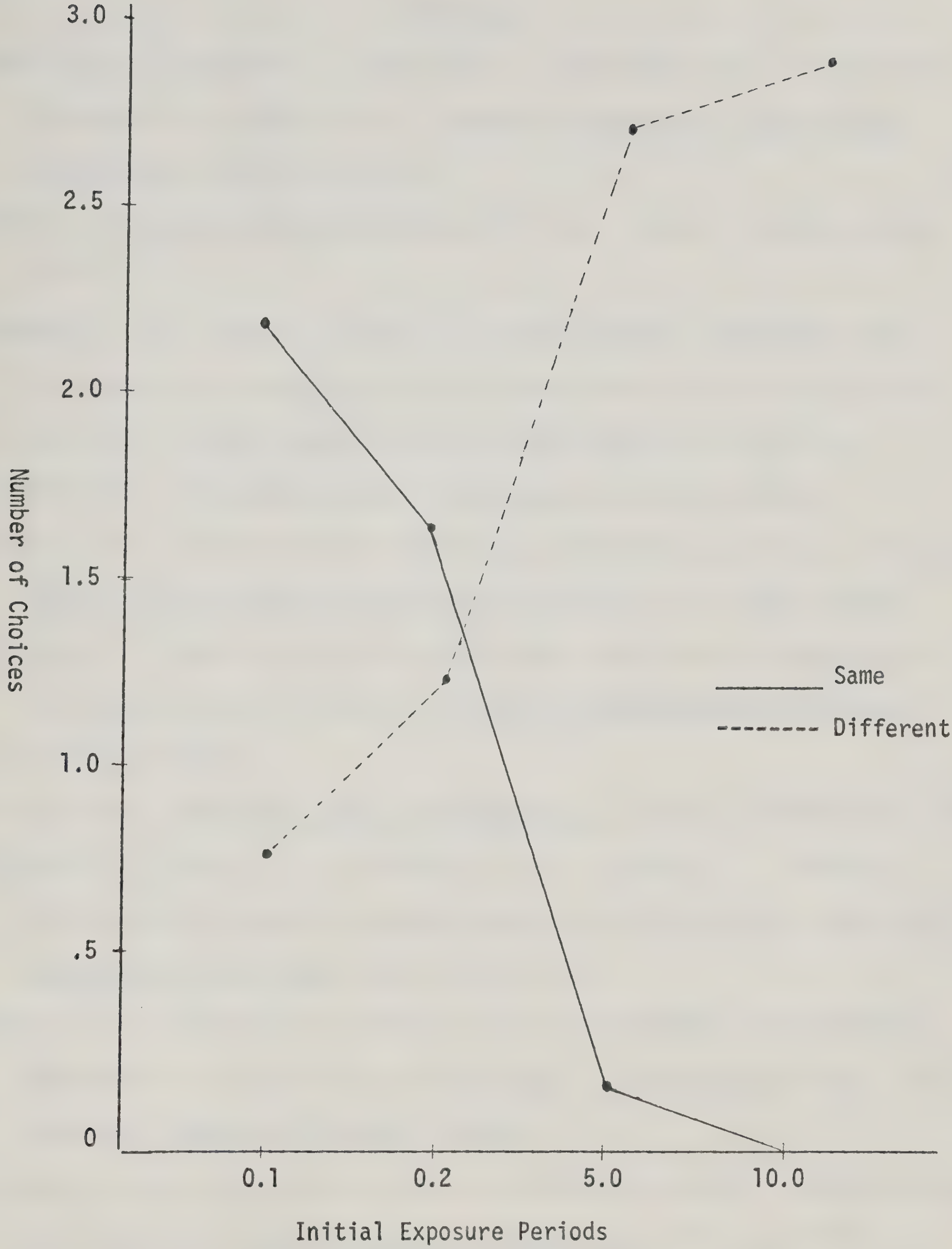


Figure 5. Choice of Same or Different Second Exposure Condition (A) for each level of Initial Exposure (B)

REFERENCES

Alderstein, A., & Fehrer, E. The effect of food deprivation on exploratory behaviour in a complex maze. Journal of Comparative Physiological Psychology, 1955, 48, 250-253.

Bain, A. The senses and the intellect (3rd Ed.), London: Longmans Green, 1868.

Bechtoldt, H. P. Factorial study of perceptual speed. Unpublished Ph.D. Dissertation: Department of Psychology, University of Chicago, 1947.

Berlyne, D. E. Novelty and curiosity as determinants of exploratory behaviour. British Journal of Psychology, 1950, 41, 68-80.

Berlyne, D. E. The arousal and satiation of perceptual curiosity in the rat. Journal of Comparative Physiological Psychology, 1955, 48, 238-246.

Berlyne, D. E. Conflict and information-theory variables as determinants of human perceptual curiosity. Journal of Experimental Psychology, 1957, 53, 399-404.

Berlyne, D. E. Conflict, arousal and curiosity. New York: McGraw-Hill, 1960.

Berlyne, D. E., Craw, M. A., Salatapek, P. H., & Lewis, J. L. Novelty, complexity, incongruity, extrinsic motivation and the GSR. Journal of Experimental Psychology, 1963, 66, 560-567.

Berlyne, D. E. Motivational problems raised by exploratory and epistemic behaviour. In S. Koch (Ed.), Psychology: A study of a science. Vol. 5. New York: McGraw-Hill, 1963, 284-364.

Berlyne, D. E., & Lewis, J. L. Effects of heightened arousal on human exploratory behaviour. Canadian Journal of Psychology, 1963, 17, 398-411.

Berlyne, D. E., & McDonnell, P. Effects of stimulus complexity and incongruity on duration of EEF desynchronization. Electroencephalogical Clinical Neurophysiology, 1965, 18, 156-161.

Botzum, William. A factorial study of the reasoning and closure factors. Psychometrika, 1951, 16, 361-386.

Butler, R. A. The effect of deprivation of visual incentives on visual exploration motivation in monkeys. Journal of Comparative Physiological Psychology, 1957, 55, 177-179.

deLorge, J., & Bolles, R. C. Effects of food deprivation on exploratory behaviour in a novel situation. Psychological Reports, 1961, 9, 599-606.

Dember, W. N. Response by the rat to environmental change. Journal of Comparative Physiological Psychology, 1956, 49, 93-95.

Dember, William N. Psychology of perception. Holt, Rinehart and Winston, 1961.

Dennis, W. A. Comparison of the rats first and second exploration of a maze unit. American Journal of Psychology, 1935, 47, 488-490.

Dennis, W., & Sollenberger, R. T. Negative adaptation in the maze exploration of albino rats. Journal of Comparative Psychology, 1934, 18, 197-206.

Fiske, D. W., & Maddi, S. R. A conceptional framework. In D. W. F. Fiske and S. R. Maddi (Eds.), Functions of varied experience. Homewood, Ill.: Dorsey, 1961, 11-56.

Fowler, H. Curiosity and exploratory behaviour. New York: Macmillan, 1965, 3-77.

Fowler, H. Satiation and curiosity: Constructs for a drive and incentive-motivational theory of exploration. In K. W. Spence and J. T. Spence (Eds.), The psychology of learning and motivation. 1 New York, N.Y.: Academic Press, 1967.

Fox, S. S. Self-maintained sensory input and sensory deprivation in monkeys. Journal of Comparative Physiological Psychology, 1962, 55, 438-444.

Glanzer, M. Stimulus satiation: An explanation of spontaneous alternation and related phenomena. Psychological Revue, 1953, 60, 257-268. (a)

Glanzer, M. The role of stimulus satiation in spontaneous alternation. Journal of Experimental Psychology, 1953, 45, 387-393. (b)

Greenberger, E., Woldman, J., & Yourshaw, S. W. Components of curiosity: Berlyne reconsidered. British Journal of Psychology, 1967, 58, 375-386.

Harlow, H. F. Motivation as a factor in the acquisition of new responses. In current theory and research in motivation. Lincoln: University of Nebraska Press, 1953, 24-49.

Heathers, G. L. The avoidance of repetition of a maze reaction in the rat as a function of the time between trials. Journal of Psychology, 1940, 10, 359-380.

Hebb, D. O. Drives and the C.N.S. (Conceptual Nervous System). Psychological Revue, 1955, 62, 243-254.

Henderson, R. L. Stimulus-intensity dynamism and secondary reinforcement. Journal of Comparative Physiological Psychology, 1957, 50, 339-344.

Hull, C. L. Principles of behaviour. New York: Appleton Century-Crofts, 1943.

Hull, C. L. A behaviour system: An introduction to behaviour theory concerning the individual organism. New Haven: Yale University Press, 1952.

Kivy, P. N., Earl, R. W., & Walker, E. L. Stimulus context and satiation. Journal of Comparative Physiological Psychology, 1956, 49, 90-92.

Koffka, K. Principles of gestalt psychology. New York: Harcourt Brace, 1935.

Leuba, C. Toward some integration of learning theories: The concept of optimal stimulation. Psychological Reports, 1955, 1, 27-33.

Miles, R. C. Learning in kittens with manipulatory, exploratory and food incentives. Journal of Comparative Physiological Psychology, 1958, 51, 39-42.

Mooney, C. M., & Ferguson, G. A. A new closure test. Canadian Journal of Psychology, 1951, 5, 129-133.

Mooney, Craig M. Age in the development of closure ability in children. Canadian Journal of Psychology, 1957, 11, 219-226.

Montgomery, K. C. A test of two explanation of spontaneous alternation. Journal of Comparative Physiological Psychology, 1952, 45, 287-293.

Montgomery, K. C. The effect of hunger and thirst drives upon exploratory behaviour. Journal of Comparative Physiological Psychology, 1953, 46, 315-319.

Myers, A. K., & Miller, N. E. Failure to find a learned drive based on hunger; evidence for learning motivated by "Exploration." Journal of Comparative Physiological Psychology, 1954, 47, 428-436.

Pemberton, Carol. The closure factors related to other cognitive processes. Psychometrica, 1952, 17, 267-288. (a)

Pemberton, Carol. The closure factors related to temperament. Journal of Personality, 1952, 21, 159-175. (b)

Richards, W. J., & Leslie, G. R. Food and water deprivation as influences on exploration. Journal of Comparative Physiological Psychology, 1962, 55, 834-837.

Solomon, R. L. The role of effort in the production of several related behaviour phenomena. Unpublished doctoral dissertation, Brown University, 1947.

Solomon, R. L. The influence of work on behaviour. Psychological Bulletin, 1948, 45, 1-40.

Spence, K. W. Behaviour theory and conditioning. New Haven, Conneticut: Yale University Press, 1956.

Stewart, J. Reinforcing effect of light as a function of intensity and reinforcement schedule. Journal of Comparative Physiological Psychology, 1960, 53, 187-193.

Street, R. F. A gestalt completion test. New York: Teachers College, Columbia University, 1931.

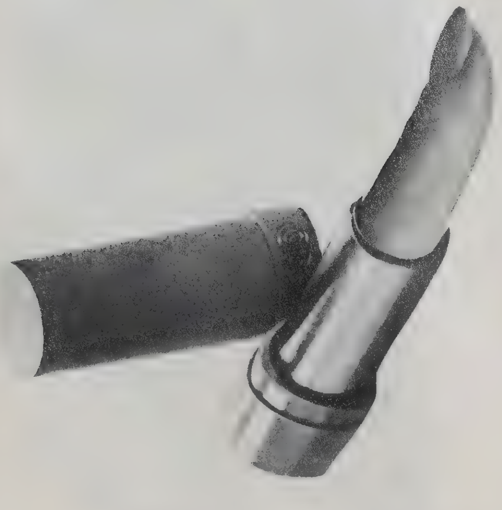
Thurstone, L. L. A factorial study of perception. Chicago University of Chicago Press, 1944.

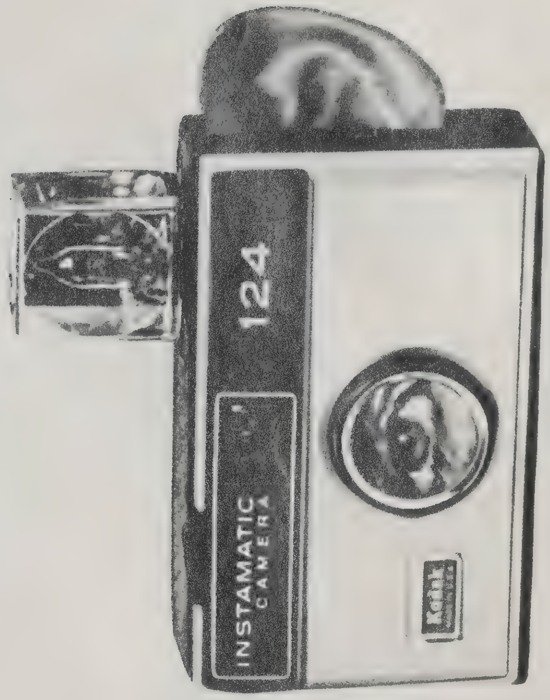
Tolman, E. C. Purpose and cognition: The determiners of animal learning. Psychological Review, 1925, 32, 285-297.

Winer, B. J. Statistical principles in experimental design. New York: McGraw Hill, 1962, 222-224.

Zeaman, D., & House, Betty J. The growth and decay of reactive inhibition as measured by alternation of behaviour. Journal of Experimental Psychology, 1951, 41, 177-186.

APPENDIX A

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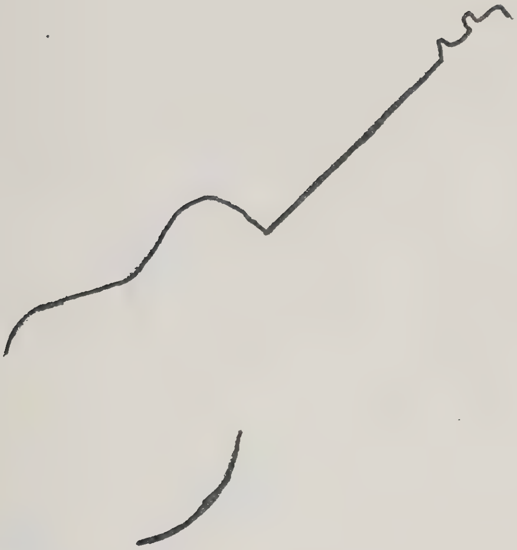
APPENDIX B



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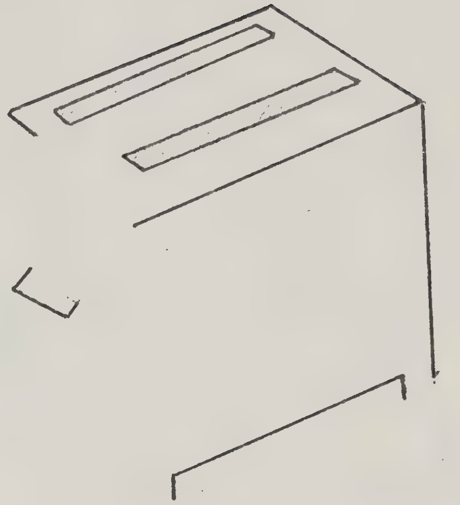

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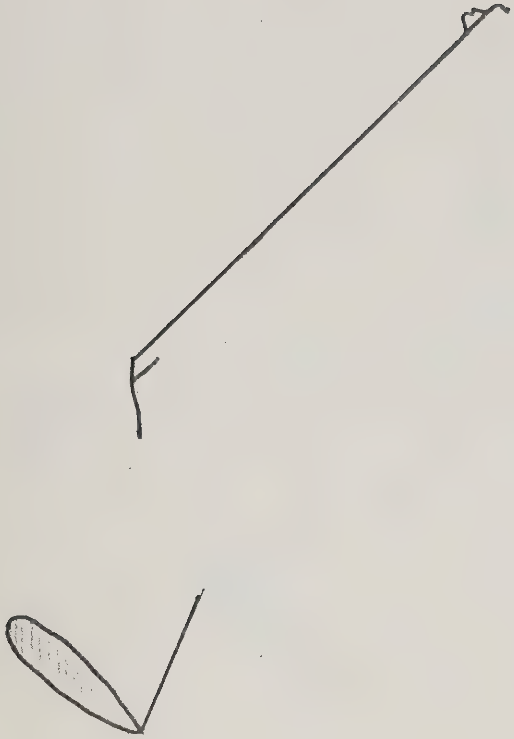

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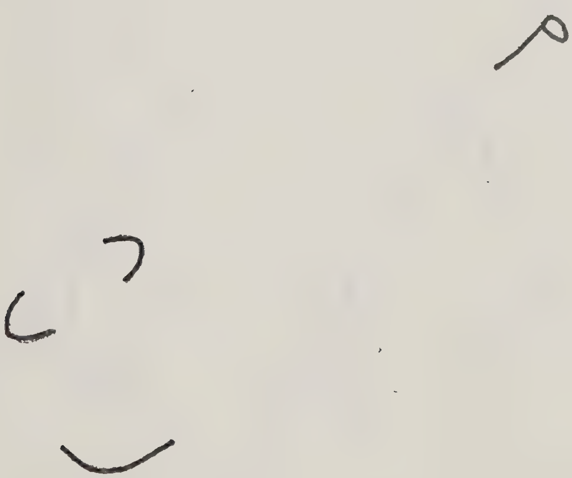

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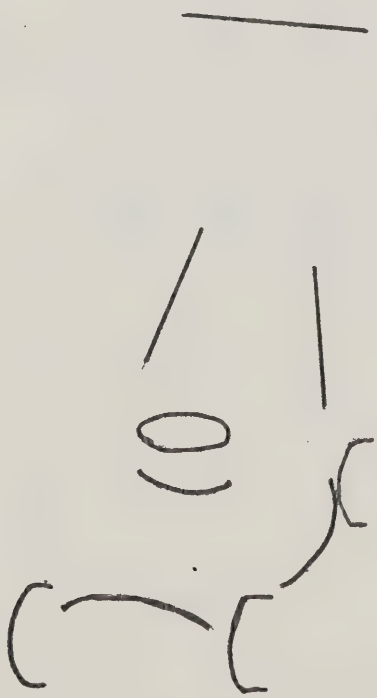

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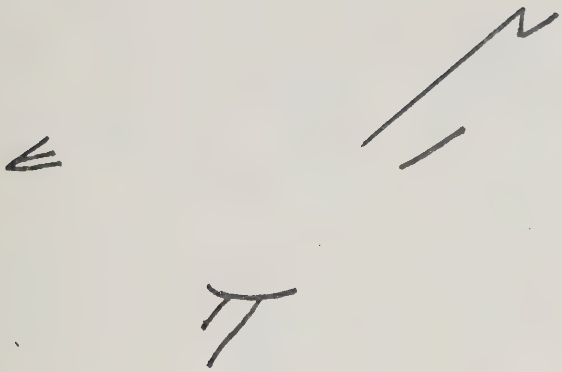

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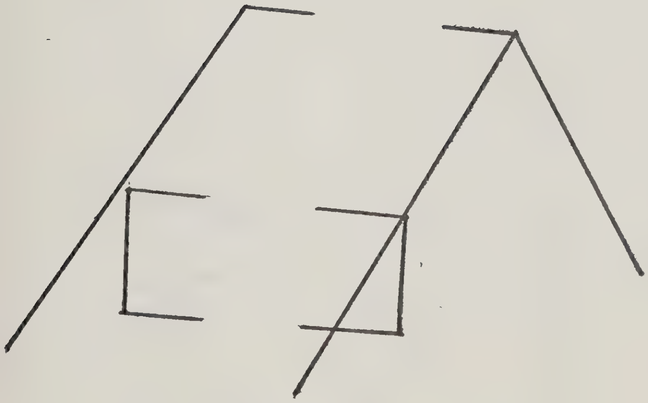

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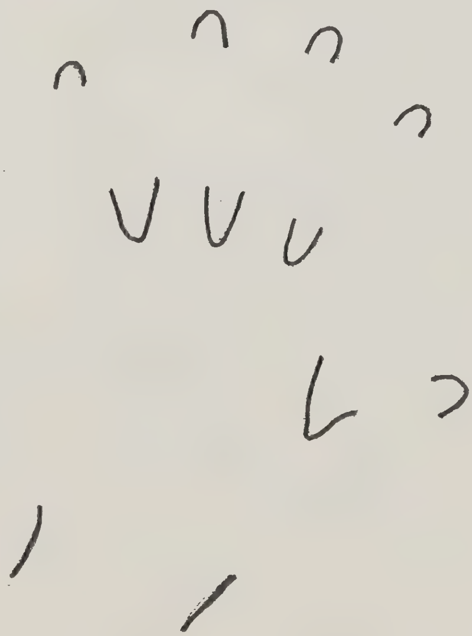

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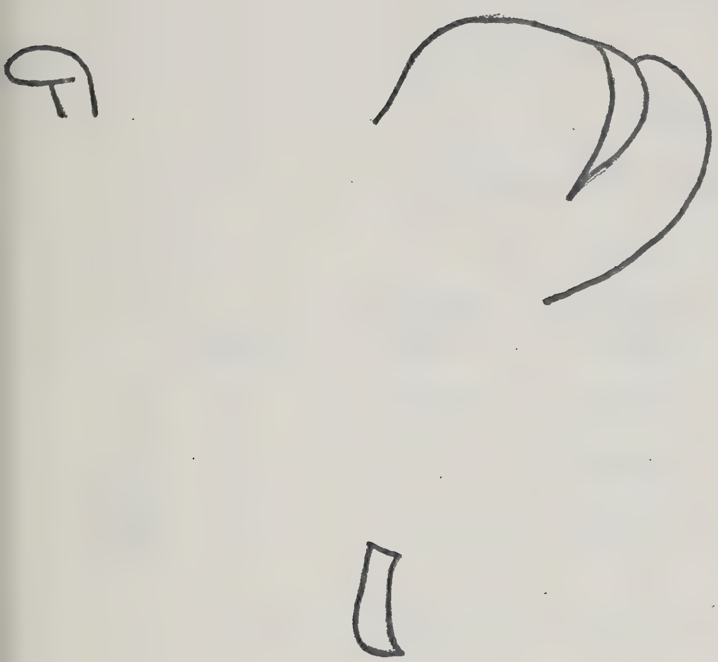

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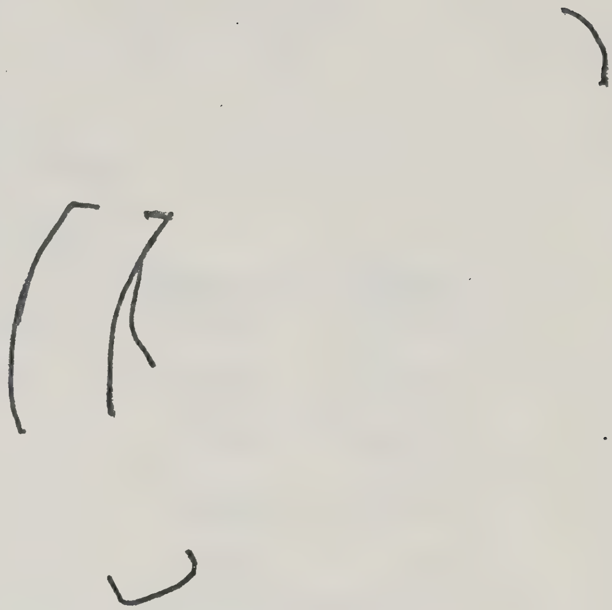

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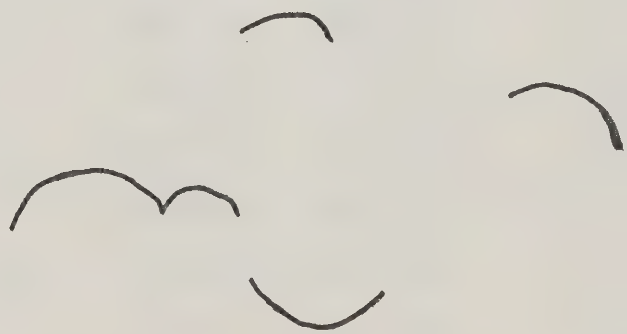

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APPENDIX C

Table 1

Duration of Initial Exposure

Brief (B) or Extended (E)

	Slide #	Exposure Series 1	Exposure Series 2	Slide #	Exposure Series 1	Exposure Series 2
Training Trials	1	10.0 (E)	0.1 (B)	17	10.0 (E)	0.1 (B)
	2	0.1 (B)	10.0 (E)	18	0.1 (B)	10.0 (E)
	3	5.0 (E)	0.2 (B)	19	5.0 (E)	0.2 (B)
	4	0.2 (B)	5.0 (E)	20	0.2 (B)	5.0 (E)
Experimental Trials	5	0.2 (B)	5.0 (E)	21	0.2 (B)	5.0 (E)
	6	0.1 (B)	10.0 (E)	22	0.1 (B)	10.0 (E)
	7	5.0 (E)	0.2 (B)	23	5.0 (E)	0.2 (B)
	8	5.0 (E)	0.2 (B)	24	5.0 (E)	0.2 (B)
	9	10.0 (E)	0.1 (B)	25	10.0 (E)	0.1 (B)
	10	0.1 (B)	10.0 (E)	26	0.1 (B)	10.0 (E)
	11	0.2 (B)	5.0 (E)	27	0.2 (B)	5.0 (E)
	12	5.0 (E)	0.2 (B)	28	5.0 (E)	0.2 (B)
	13	0.2 (B)	5.0 (E)	29	0.2 (B)	5.0 (E)
	14	10.0 (E)	0.1 (B)	30	10.0 (E)	0.1 (B)
	15	10.0 (E)	0.1 (B)	31	10.0 (E)	0.1 (B)
	16	0.1 (B)	10.0 (E)	32	0.1 (B)	10.0 (E)
		n = 10	n = 10		n = 10	n = 10
"Same Condition"		n = 5	n = 5		n = 5	n = 5
"Different Condition"		n = 5	n = 5		n = 5	n = 5

APPENDIX D

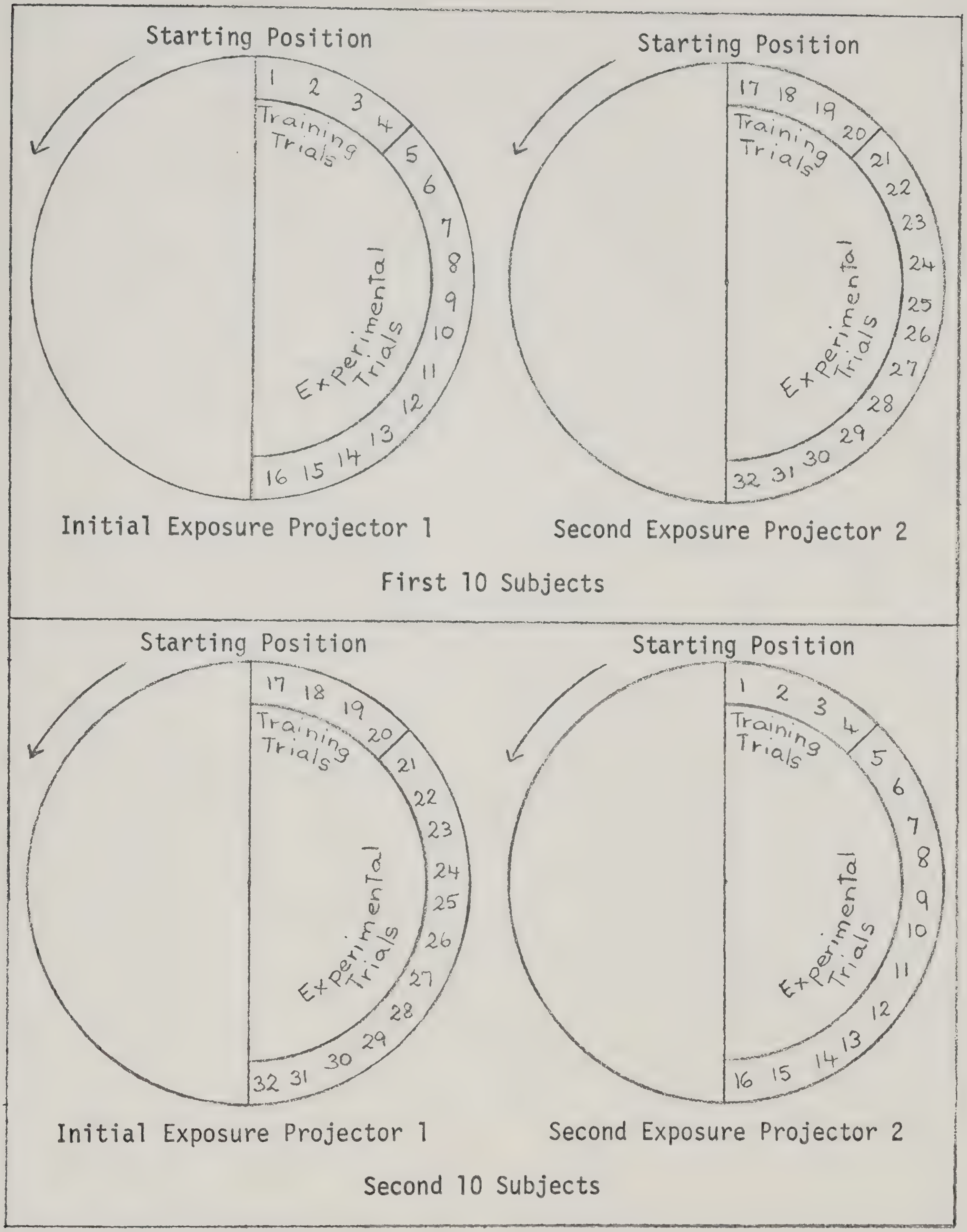

Diagram of

Presentation Order of Stimulus Slides

in The Projector Carousels

for Subjects in the "Different Condition"

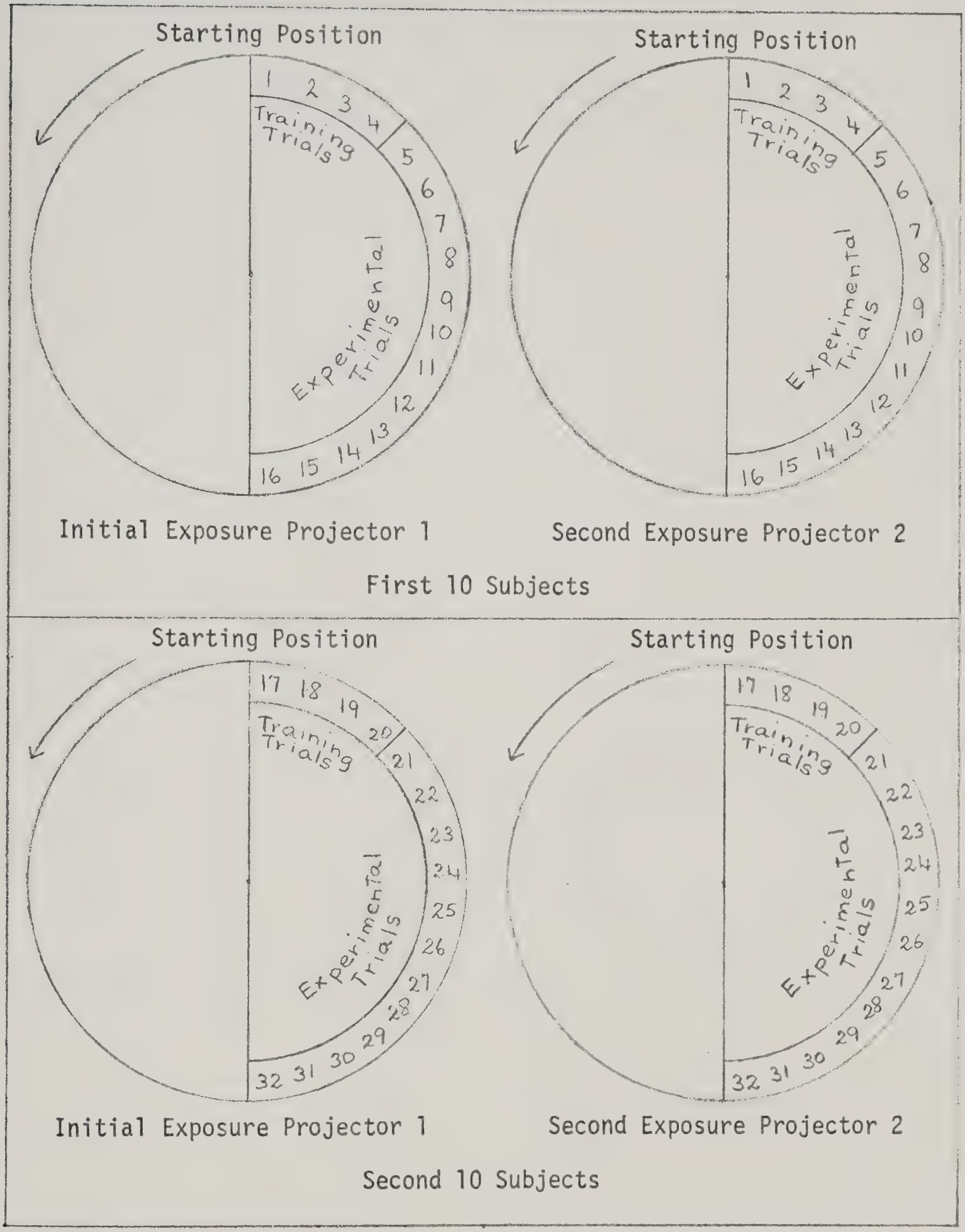

Diagram of

Presentation Order of Stimulus Slides

in The Projector Carousels

For Subjects in the "Same Condition"